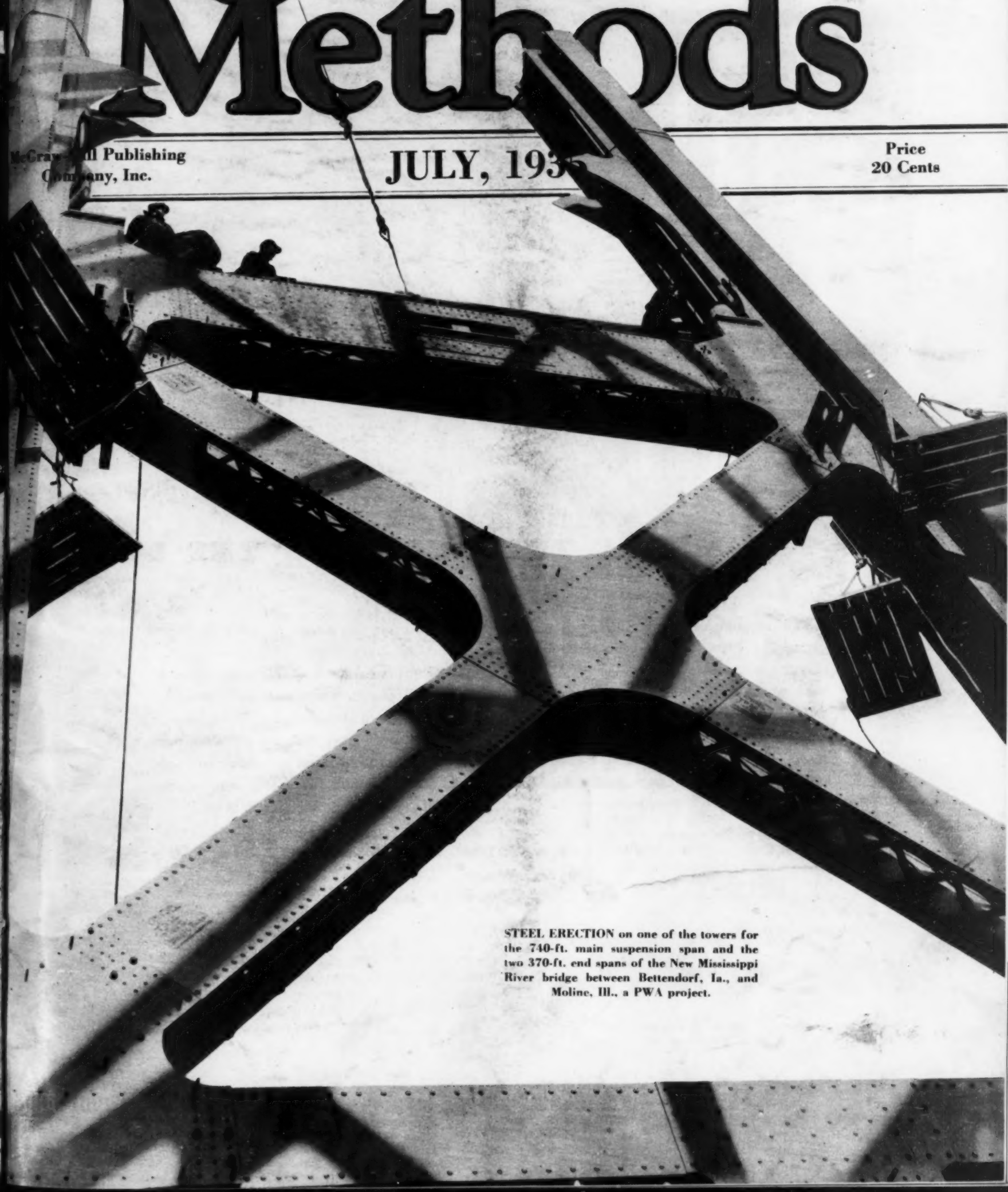
Construction Methods

McGraw-Hill Publishing Company, Inc.

JULY, 193[illegible]

Price 20 Cents



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Construction Methods

McGraw-Hill Publishing Company, Inc.,
330 West 42nd St., New York

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JULY, 1935

WILLARD CHEVALIER, Vice-President

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Leonard H. Church (Cleveland), Nelle Fitzgerald

Duffy, in The Sun, Baltimore

Skillful Cutting Called For

Make the Works Policy Workable

● Developments since the $4,000,000,000 Emergency Relief Appropriation Act was approved April 8 have distorted almost beyond recognition the picture of a nation-wide public works program as then outlined. The original earmarking of large sums for specific construction purposes, such as road building, grade crossing elimination, housing and local non-federal public works, coupled with the specific declaration in Section 8 of the Act that "wherever practicable . . . full advantage shall be taken of the facilities of private enterprise," led naturally to the assumption that a considerable portion of the program would be undertaken by normal contract methods, involving the use of skilled construction organizations and equipment and materials on a scale that would not only swell job payrolls but also would stimulate a vast amount of secondary "off-the-site" employment in the many and diversified industries serving the needs of construction. While the actual undertaking of the work relief program is still waiting upon organization of the administrative machinery in the field, the policy that will govern the program appears, at this writing, to have moved definitely away from public works—as that term is understood by engineers and contractors—as an instrument of recovery, and toward relief projects of the C.W.A. leaf-raking and "boondoggling" types.

The yardstick determining the eligibility of projects under the present set-up is fashioned simply by dividing the $4,000,000,000 works appropriation by the 3,500,000 unemployed persons now carried on relief rolls, resulting in a quotient of approximately $1,140 per worker per year. This is the maximum sum, according to official dictum, that may be spent for labor, materials and equipment on works projects, except in the case of highway construction, where the limit is raised to $1,400. Obviously this formula, if it is strictly adhered to, would remove from consideration heavy construction of useful permanent types, and would concentrate spending upon a multitude of simple hand-labor operations of inconsequential, temporary value.

It is difficult to reconcile this prospect with the President's previously stated principle that: "All work undertaken should be useful—not just for a day or a year, but useful in the sense that it affords permanent improvement in living conditions or that it creates future new wealth for the nation." By reverting to the pick-and-shovel methods of past generations in handling works projects under the present program the President is turning back to the very horse-and-buggy days to which he alluded with bitterness in his comment on the Supreme Court decision nullifying the NRA. Adherence to present policies may give temporary employment at subsistence wages to individuals now on relief rolls, but at the same time it will divert to bread lines thousands of skilled construction workers whose jobs will be wiped out by the influx of "relief-rollers" into the field upon which the construction man depends for his livelihood. Up to date little, if any, reemployment has resulted from any actual work undertaken as part of the emergency works program.

Progress promises to be slow, organization bureaucratic and clumsy and results so far short of the mark set as to force a revision of plans along normal lines of contract work. There may be some hope, however, in the fact that on the very day last month when he was appointed by the President as Works Progress Administrator for the important New York metropolitan area, Gen. Hugh S. Johnson, in his daily column in the *New York World-Telegram*, condemned the Works Progress Administration's $1,140-per-man yardstick, characterizing it as a practical ban on useful and permanent projects. "It may be all practical horse-sense," said the former NRA Administrator, "but it looks like $4,000,000,000 worth of boondoggling to me." He will perform a useful service if he can gain acceptance of these beliefs in Washington.

Loophole on PWA Projects

● In spite of the apparent ban on heavy construction imposed by the Works Progress Administration's cost limit of $1,140 per man per year, Administrator Ickes, of PWA, is hopeful that many non-federal projects will be accepted as coming within the range of acceptability by computing this sum on the amount of money the federal government contributes. If a municipality applies for a 45 per cent grant and borrows the remainder elsewhere, the cost of the project to the federal government, in terms of the men employed, obviously will be low and will permit its inclusion in the program of many loan-and-grant projects in which the government allots 100 per cent of the cost in the first instance.

Highways and Grade-Crossing Elimination

● Allotments of $200,000,000 for highway construction and a like amount for elimination of grade crossings have been apportioned among the states with instructions that the cost of a project, per man employed per year, shall not exceed $1,400, with an alternative in the case of grade crossing work that 40 per cent of the total cost, including the cost of the property, shall go to labor directly employed on the project. This will necessitate recasting of state programs that were all ready for award of contracts. As this limitation does not apply to $125,000,000 of federal-aid money available to the states nor to $100,000,000 which they are planning to spend on their own account, it will be possible to spend the work relief allotment on grading and drainage and, thereafter, surface a considerable portion of this mileage out of the regular funds.

Plan to Pool Highway Funds

● President Roosevelt is said to be favorably impressed by the plan for pooling the $400,000,000 work-relief allotment for roads and grade-crossing elimination with state roads funds, with no limitation as to its use except that each state will guarantee to employ on highway work for one year the same number of workers from relief rolls that would be absorbed by applying the $1,400 per-man-per-year requirement to its work-relief allotment.

This plan to accomplish the objective of the work-relief program and at the same time maintain the usual standards of highway construction was suggested by Henry G. Shirley, chairman of the Virginia State Highway Commission, and submitted to President Roosevelt by Thomas H. MacDonald, chief of the U.S. Bureau of Public Roads. On the basis outlined, each state would contract with the federal government to employ the requisite number of men.

The plan would permit state highway departments to proceed with previously developed construction programs without further delay.

SPEED *the Trend* TOWARD REASON

AS THIS IS WRITTEN the construction industry is recovering from its first disappointment over the announced work relief program. It has valid reasons for renewed hope; yet it would be futile to discount the shock of so radical a reversal of the program laid down by the President only last January. This, bear in mind, was the program on which he sold Congress the $4-billion appropriation; and a lot of contractors would be glad to learn how to get a $4-billion job on one set of specifications and then, after the cash is in hand, substitute a different set. Such an accomplishment should go far toward taking the grief out of the contracting business.

But to return to the Act itself: its first sentence declares its purpose to "provide relief, work relief and to increase employment by providing for useful projects." Now any legislator, taxpayer or other citizen, reading this in the light of the President's selling message, would interpret that sentence thus: "to provide relief, WORK RELIEF and to INCREASE EMPLOYMENT BY PROVIDING FOR USEFUL PROJECTS." The President said most explicitly that "the Federal Government must and shall quit this business of relief," that he was "not willing that the vitality of our people be further sapped by the giving of * * * a few hours of weekly work cutting grass, raking leaves or picking up papers in the public parks" and that "all work undertaken should be useful" and so planned as not to interfere with existing or potential private employment.

THEN came the regulations. These, on their face, reverse the President's intention and make the purpose of the Act read like this: "to provide RELIEF, WORK RELIEF and to increase employment by providing for useful projects." For the requirement that projects must provide from $1100 to $1400 of direct labor per man-year very effectively outlaws most projects designed to meet the President's explicit and detailed specifications for useful employment. Moreover, the declared indifference of the Works Progress Administration to the effect of its program on private employment and its determination to spend the whole fund making direct jobs for those on relief are quite inconsistent with the President's avowed intention.

But despite all that, it becomes increasingly clear that the industry should not give up too readily. Sometimes a thing can be so wrong as to cry out for its own correction. Already indications are that the $4-billion will not be spent with so scant a respect for common sense, general recovery and the taxpayers' interests. We learn, for example, that grade-crossing improvement will not fall under the $1100 to $1400 rule; there is reason to expect that on highway work the rule may apply on a state-wide rather than a project basis. It seems incredible that federal and non-federal projects now under way should be wrecked by the arbitrary injection of so impracticable a rule. If the President will but keep out of the emergency relief class those non-federal public works which communities are willing to build on a PWA 45 per cent grant, these can be handled normally and yet meet the work-relief rule. Quite aside from all this, private construction is picking up consistently; and in the long run it is in that quarter that the industry must seek lasting recovery. Altogether it is no time to think of throwing up the sponge.

THIS does not mean, however, that it is a time to sit tight and wait for things to work out. Quite to the contrary the need is for united and constructive effort to activate and strengthen the corrective influences. In every state, in every important center and in their national headquarters, the various groups that compose the construction industry should be meeting, formulating their views, educating their fellow citizens and taxpayers and then maintaining close and continuous contact with their representatives in Washington, both executive and legislative.

They should make clear to all that it would do more harm than good to take men off relief rolls at the expense of those who now have or soon would have jobs in normal employment. Through the normal conduct of useful and necessary public works, both under way and projected, many real jobs have been created and many more are in sight: to absorb such projects in an ill-considered program of emergency job-making would but cancel out some real and substantial progress to make way for an extension of mere subsistence relief.

At the moment the trend is toward some sober second thought. An aroused construction industry backed by an informed public sentiment, working from out in the country back toward Washington, can help mightily to strengthen that trend.

Willard Chevalier

CONSTRUCTION METHODS. July, 1935. Volume 17, Number 7. Published Monthly, price 20¢ a copy. Subscription rates—United States, Mexico and Central and South American countries, $2.00 a year. Canada, including duty, $2.50 a year. All other countries, $4.00 a year or 16 shillings. Entered as second class matter October, 1925, at Post Office at New York, N. Y., under the act of March 3rd, 1879. Printed in U.S.A. Cable address "McGrawhill, New York." Member of A.B.P. Member of A.B.C.

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

Editorial and Publishing Offices: 330 West 42d St., New York; 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, London, W. C. 2, England. Branch Offices: Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C. James H. McGraw, Chairman of the Board; Malcolm Muir, President; James H. McGraw, Jr., Executive Vice-President; Willard Chevalier, Vice-President; H. R. Putnam, Treasurer; D. C. McGraw, Secretary.

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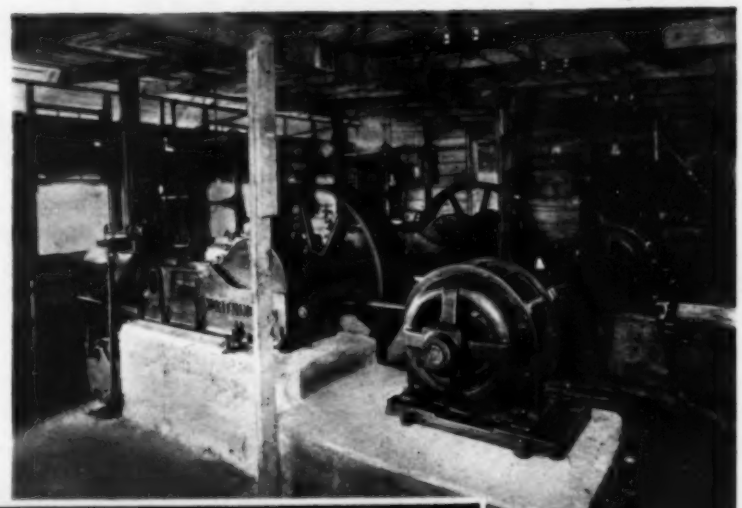

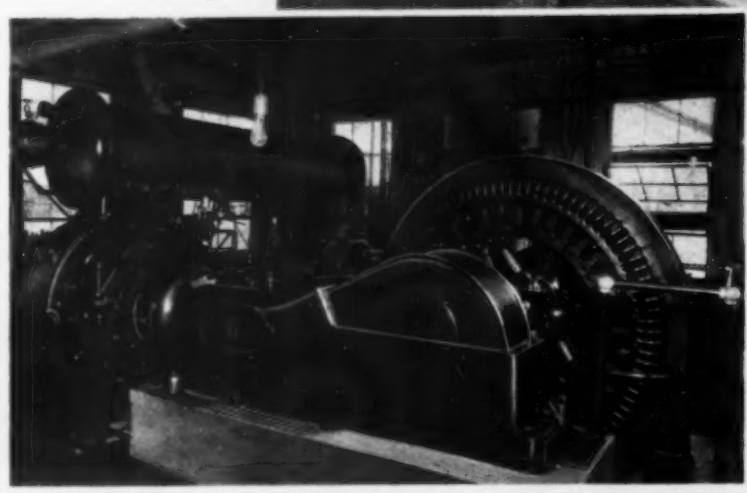

Above: Two G-E 100-hp. induction motors driving Worthington compressors supplying air for caisson and rock excavation in the construction of the University Bridge approach, Philadelphia. Contractor: Peter & A. J. Ellis.

Left: One of the Ingersoll-Rand reciprocating air compressors, each driven by a G-E 400-hp. synchronous motor, used during construction of New York City Water Tunnel No. 2. Contractor: Patrick McGovern, Inc.

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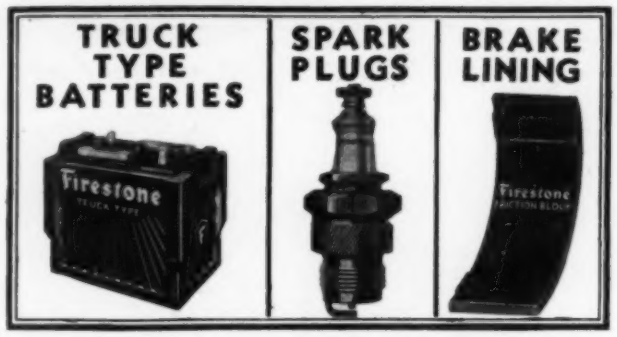

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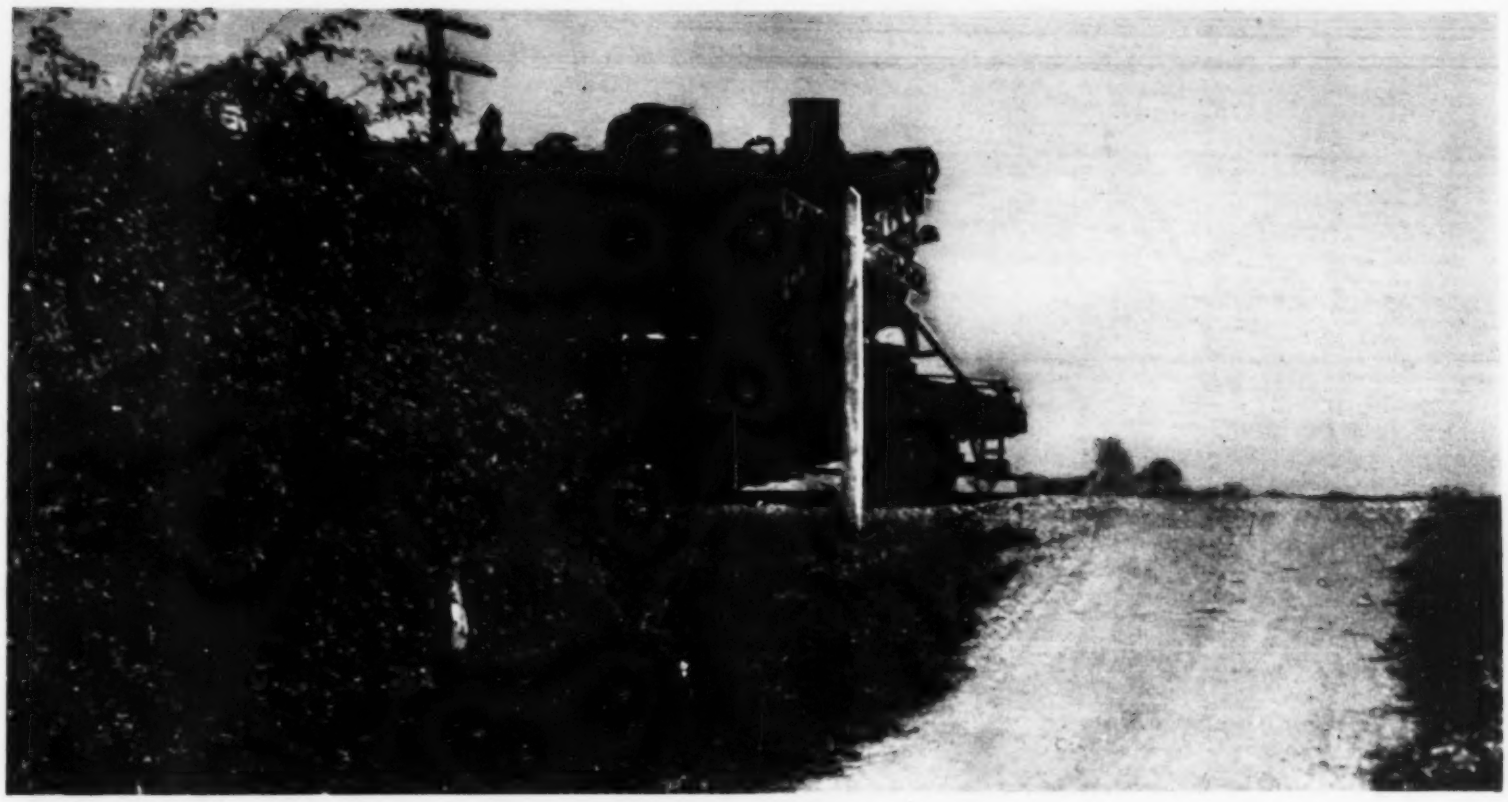

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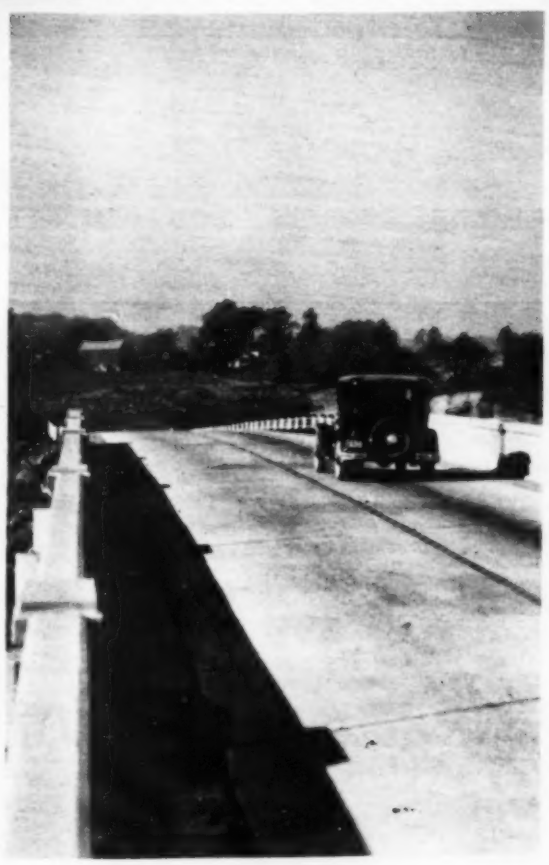

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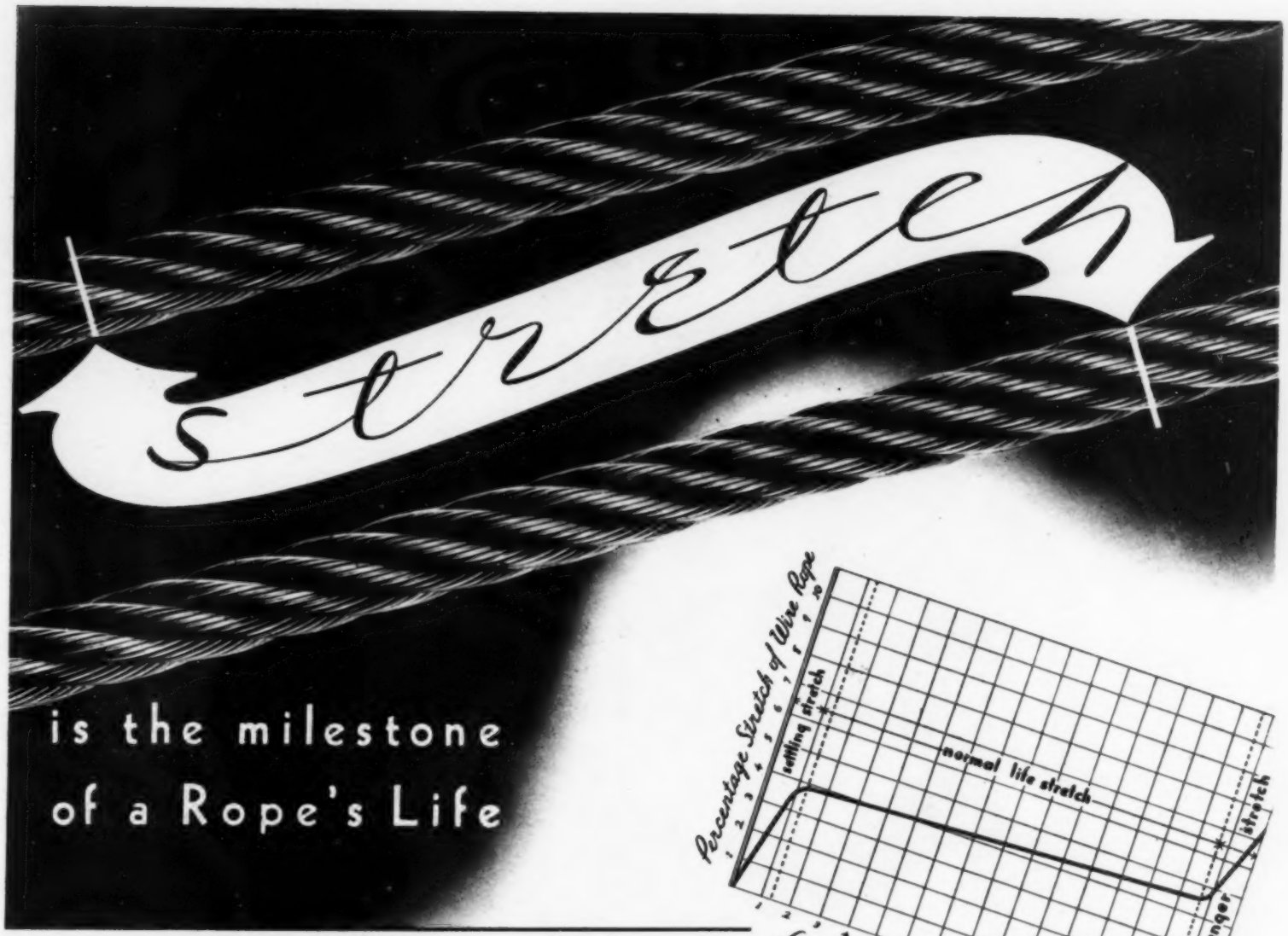

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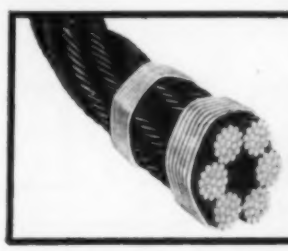

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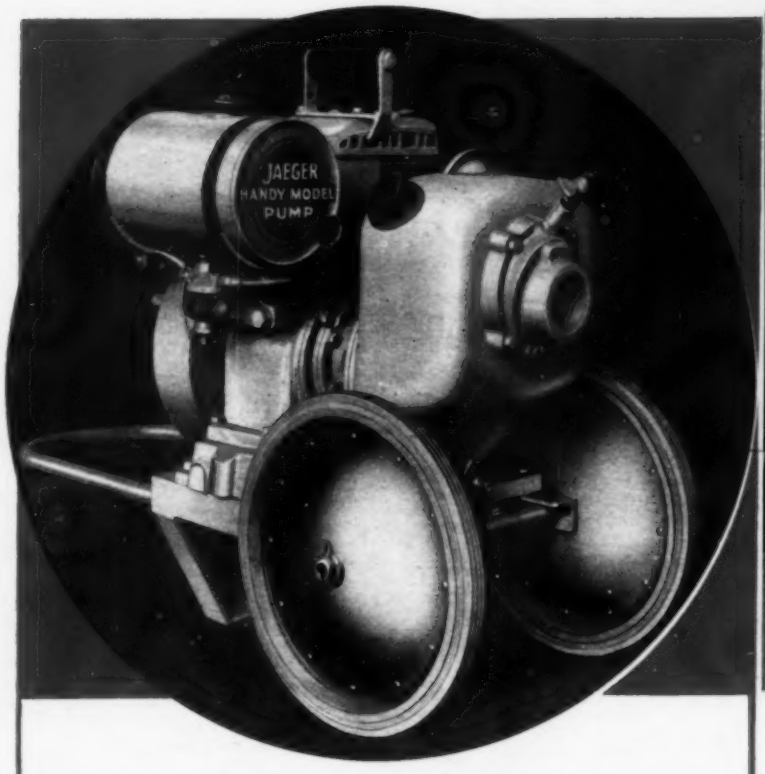

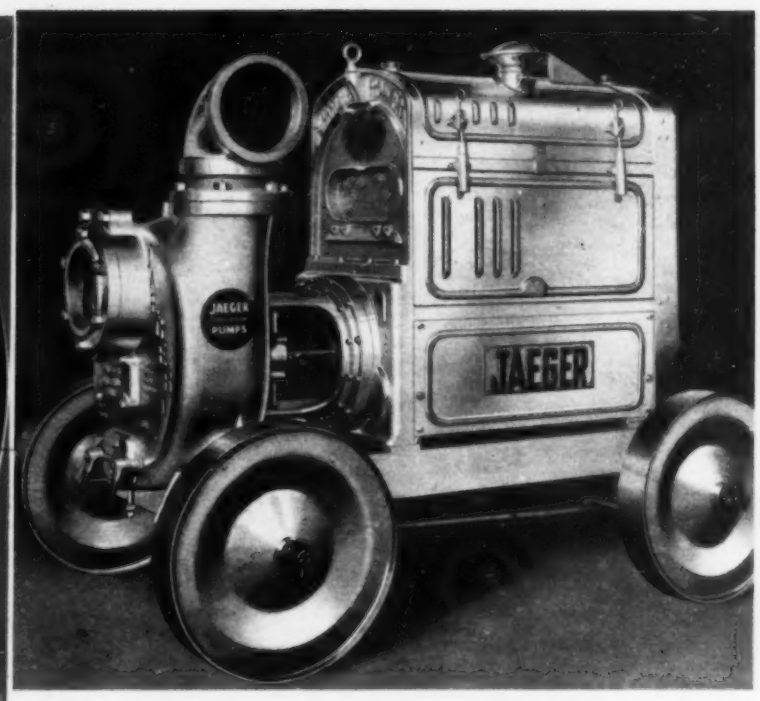

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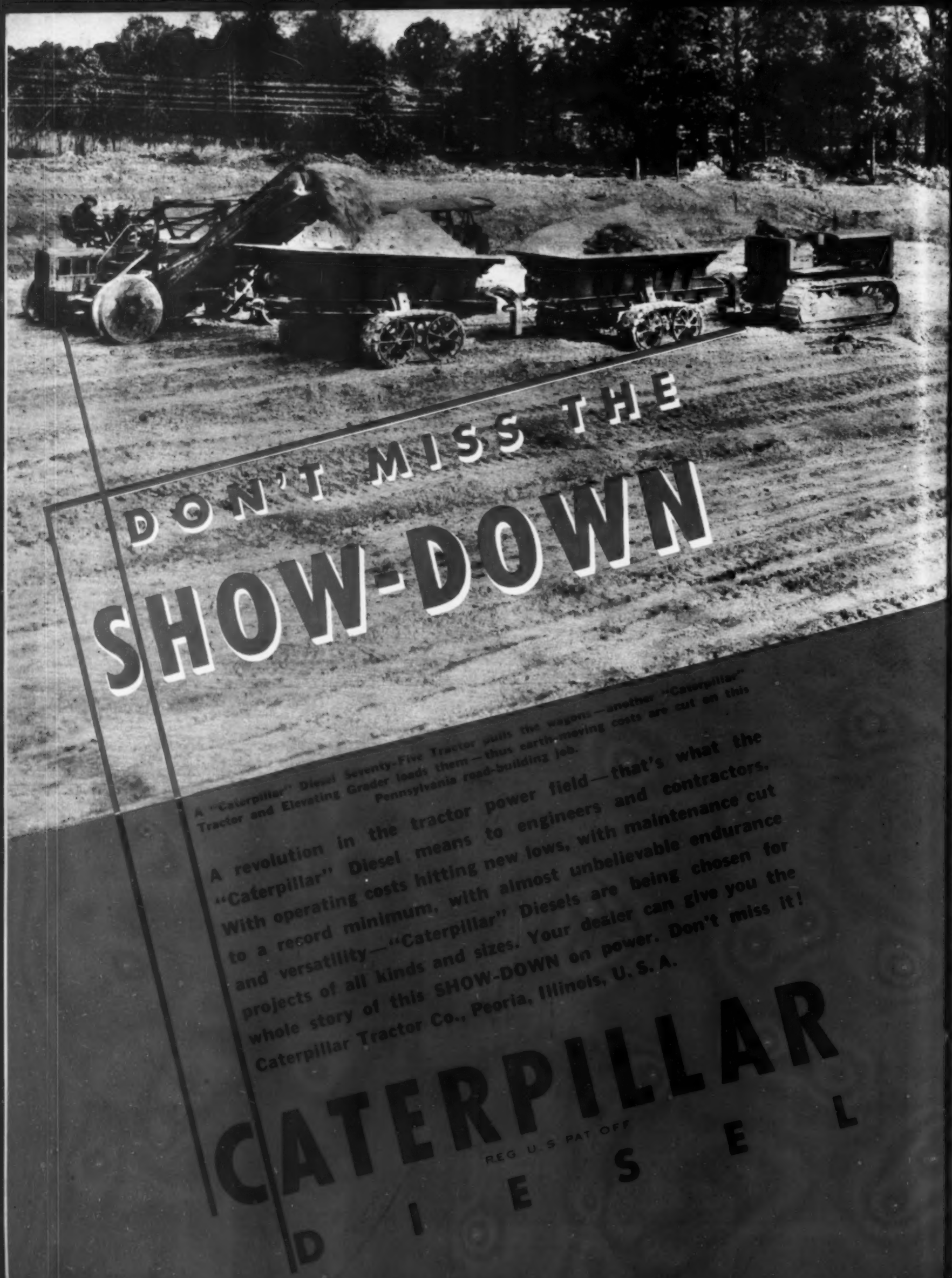

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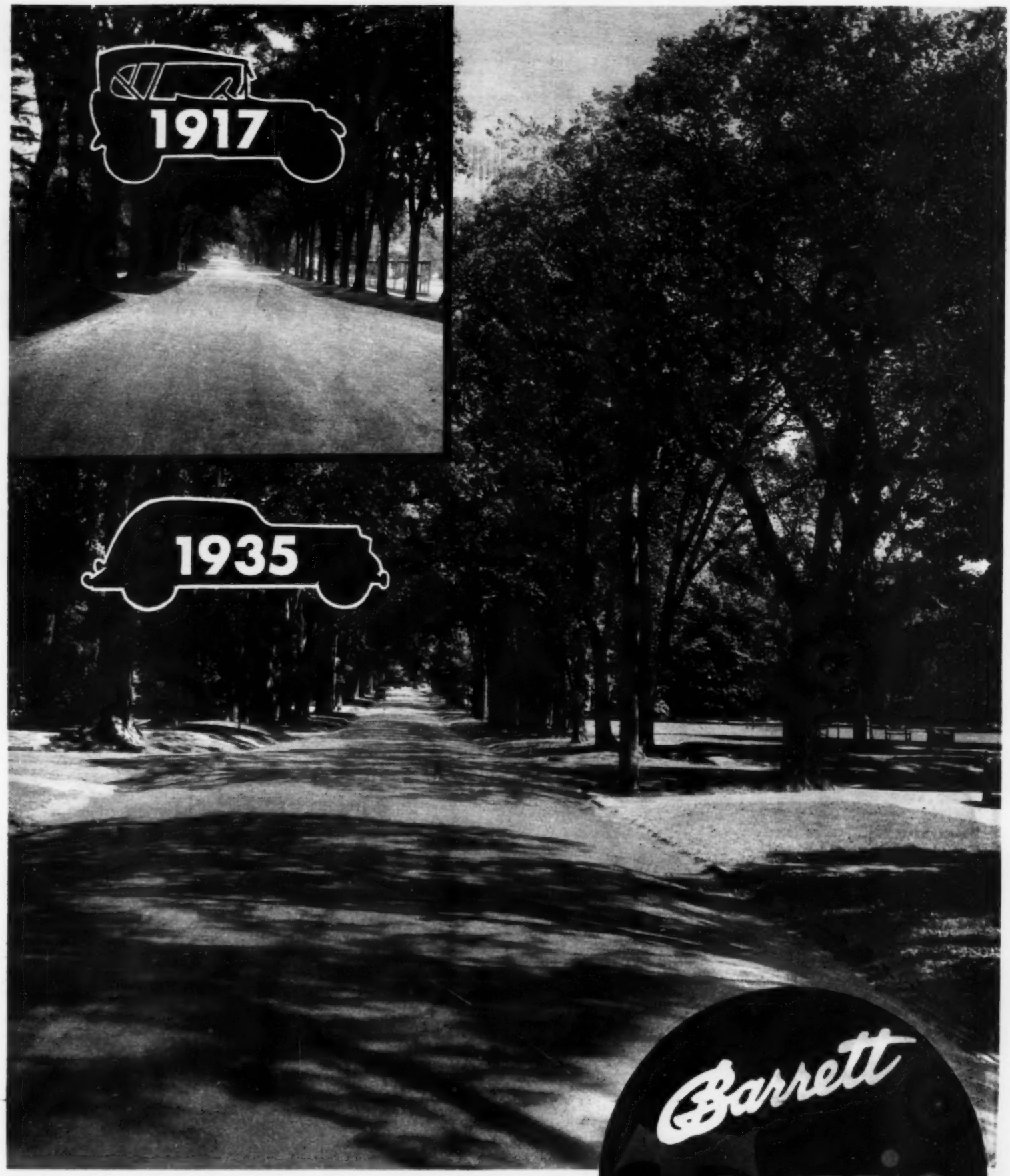

Elm Street, Winnetka. Illinois, Tarvia since 1917. As it looked then, and as it is today.

No road-building, road-maintaining material has a better right than Tarvia to associate itself with the "Good Roads at Low Cost" idea. Hundreds of roads, which have been giving completely satisfactory service since they were Tarvia-built 15, 20 or more years ago, have been helping thrifty communities put the low-cost principle into practice. Ask the Tarvia field man about them.

THE BARRETT COMPANY New York Chicago Philadelphia Birmingham Boston St. Louis Cleveland Minneapolis
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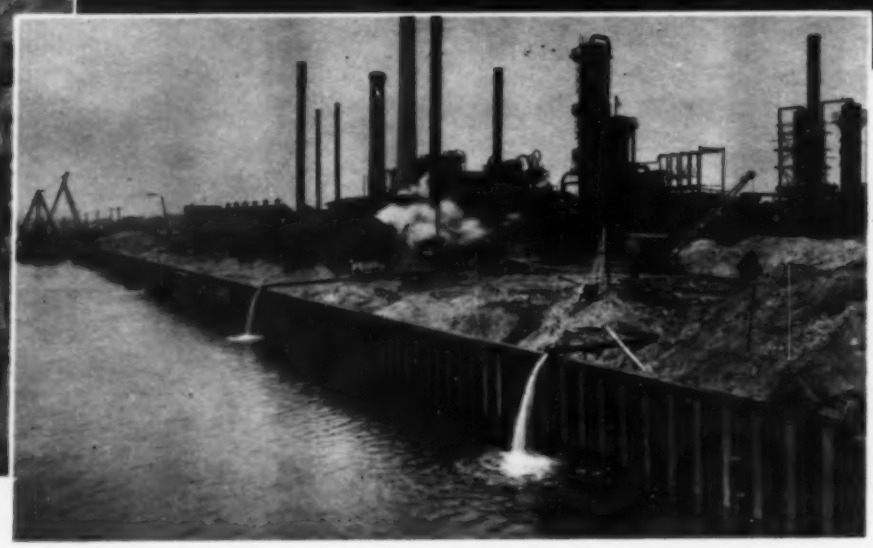
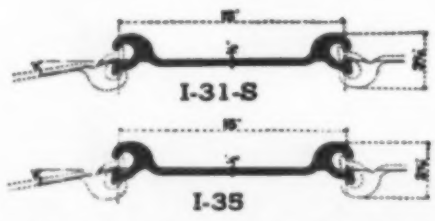
Many Use INLAND STEEL SHEET PILING As River and Harbor Development Speeds Dock Construction



Above: 350-foot dock under construction, Omaha Packing Co., Chicago River, Chicago, Ill.; 175 tons Inland Section I-27 used. *At right:* 800-foot dock, Wadhams Oil Co., East Chicago, Ind.; 600 tons Inland Section I-32 used.

New Sections



With the addition of the sections shown above Inland produces a complete line of sheet piling. Properties of the new sections:

	I-31-S	I-35
Wt. per foot	38.8 lbs.	43.8 lbs.
Wt. per square foot of wall	31.0 lbs.	35.0 lbs.
Section Modulus	3.7 in.^{3}	3.8 in.^{3}
Section Modulus per lin. ft. of wall	3.0 in.^{3}	3.1 in.^{3}
Min. Strength of interlock per lineal inch in direct tension	12,000 lbs.	12,000 lbs.

THE great Public Works program progresses—rivers are deepened, widened, placed under control—harbors are dredged, protected—and thus new avenues of transportation are made available for American industry.

Cities, states, other public agencies—industries of all description—are preparing themselves to take advantage of these new facilities. A dock building program of vast proportions is under way.

Foresighted builders are using Inland Steel Sheet Piling for these docks—assuring strength, permanence, shore protection, and an attractive installation as well.

Inland produces all of the nine standard sections of steel sheet piling. Our experienced engineers are at your service. Consult them regarding your dock building problems. INLAND STEEL COMPANY, 38 South Dearborn Street, Chicago, Illinois.

INLAND STEEL

Sheets Strip Tin Plate
Plates Structurals Piling
Rails Track Accessories
Bars Rivets Billets

KOEHRING

KOEHRING Heavy Duty Construction — Easy and positive steering in any direction, by lever control from the cab — self-equalizing double outside band friction clutches — low ground pressure — swiveling boom point fairlead for reducing cable wear—*all important features for dragline work* — available with a Koehring Dragline.

The Koehring boom point fairlead saves cable by eliminating cross pull and self-aligning the cables regardless of bucket position.

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Pavers · Mixers · Shovels · Cranes · Draglines · Dumptors · Mud-Jacks

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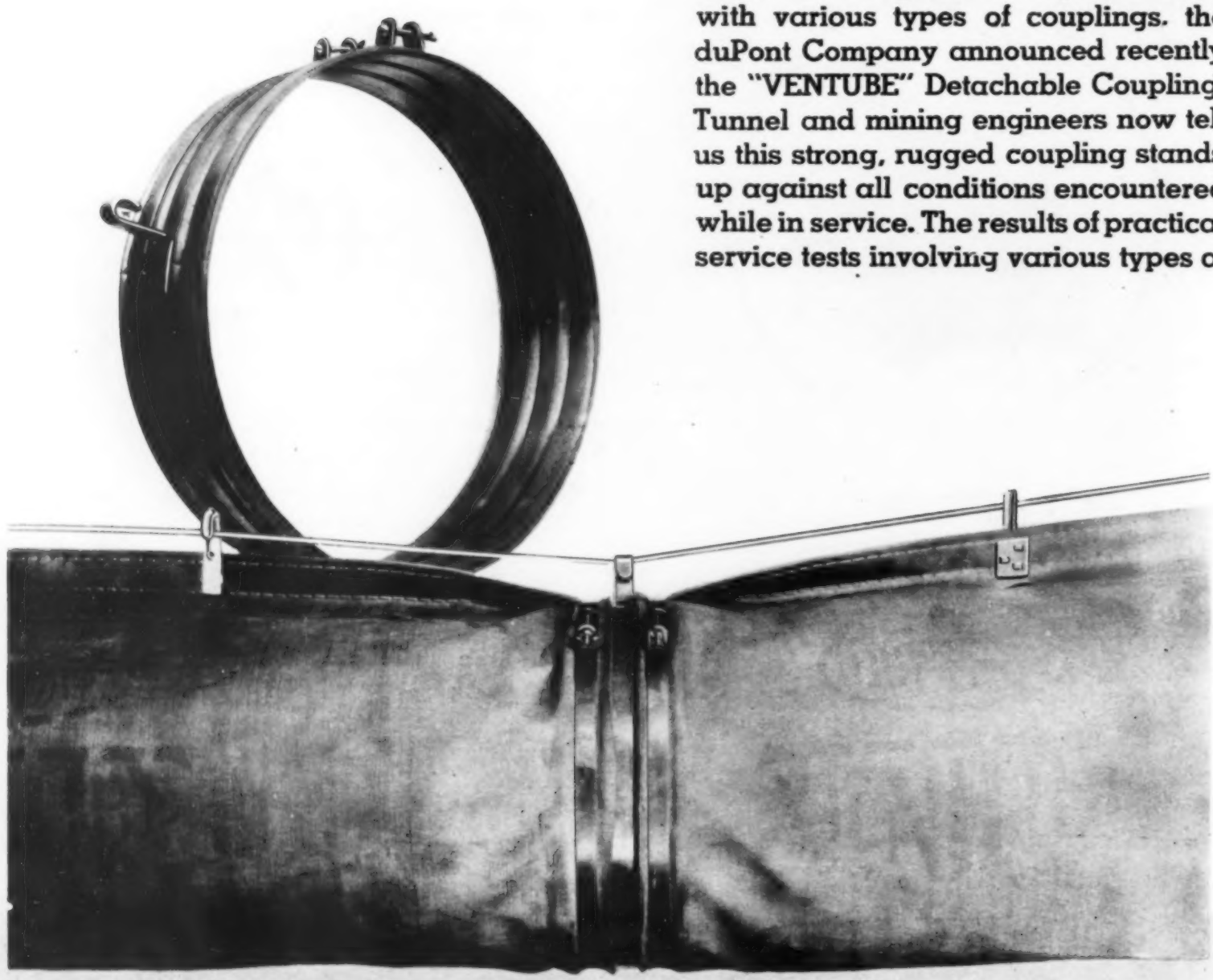
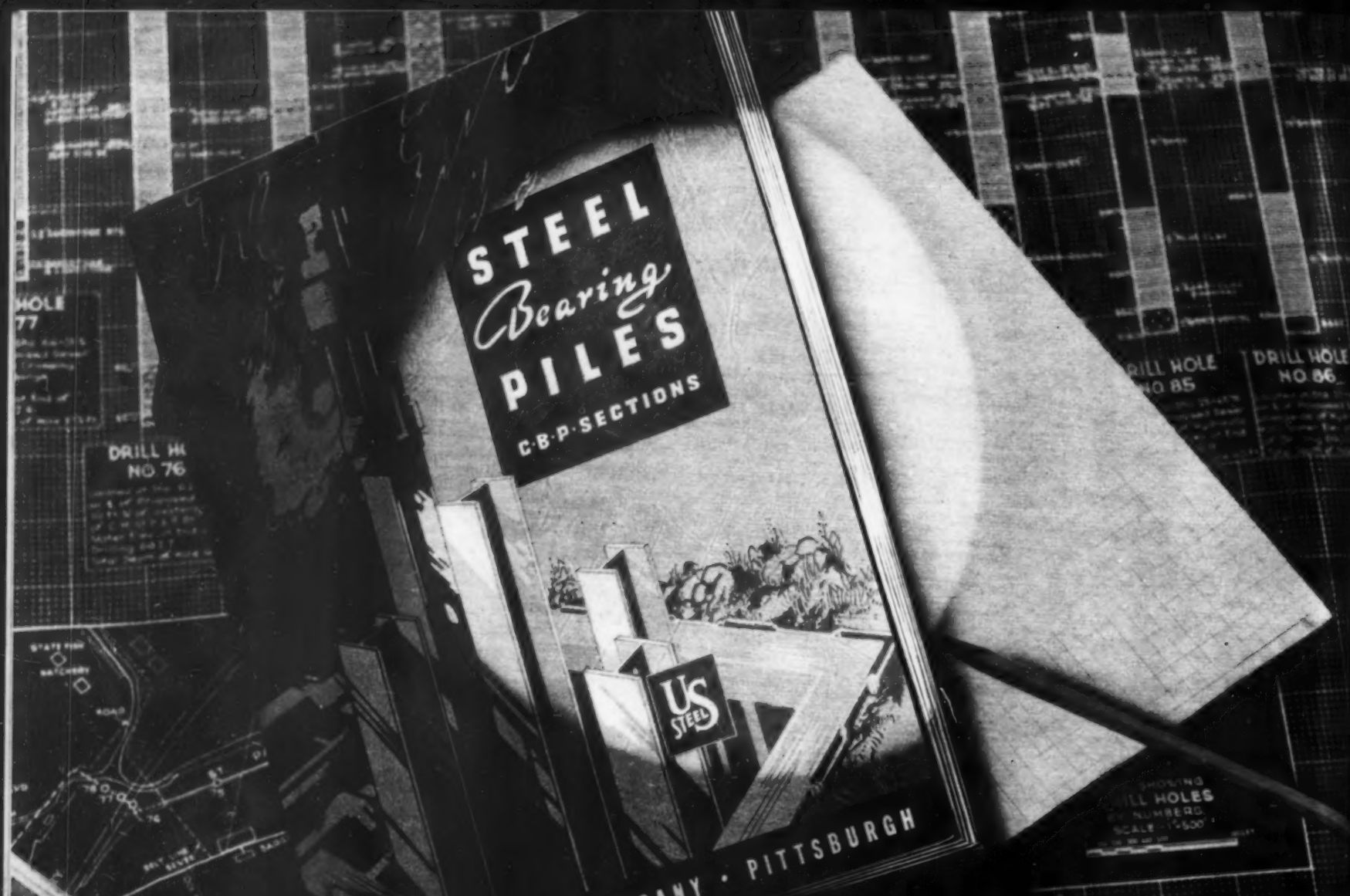
"VENTUBE

MA



After several years of experimenting with various types of couplings. the duPont Company announced recently the "VENTUBE" Detachable Coupling. Tunnel and mining engineers now tell us this strong, rugged coupling stands up against all conditions encountered while in service. The results of practical service tests involving various types of



Yours

COPY of this 80-page book is ready. You will find its profusely illustrated, data-filled pages of absorbing interest. It contains a wealth of information on the design of pile foundations and pile driving practices which, while known to a few, has never before been published for general distribution. Much of the material is entirely new, based on recent tests. All of it is of vital importance to those interested in bearing piles. Send for your copy today.

CARNEGIE STEEL COMPANY

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Joints made by overlapping cutter bar action. Positive! Accurate! No change in texture at the joint!

Handles trucks like box cars. On actual jobs Adnuns have handled 12 ton trucks on 5% grades with ease.

Be Sure YOUR BLACK TOP PAVER meets Federal Specifications

Government specifications on classes H and I Bituminous pavements call for machine laying!

Before you buy a Black Top Paver, compare the Adnun point by point with other machines. Be sure your paver meets specifications!

The Adnun will operate with headers or curb or other guide line to give positive strike-off control. It lays a perfect joint with header or curb on which the cutter bar reciprocates.

Joints are made by overlapping action. *No blades are used*, and the texture at the joints is the same as the texture in the center of the course.

A "leveling device" is standard equipment on the Adnun. This is mounted on the frame and is free from the excessive vibration present where the level must be attached to wires or connected to and affected by the oscillating action of the screed.

—And the Adnun brings you many other features—exclusive features! The power cut-off, the quick lift, and two speed cutter bar, are just a few of the many money-making advantages that the Adnun has to offer. Write for a catalog.

Roller bumpers contact the truck tires. No power lost to excess friction. No wear on tires.

Smooth as Concrete

THE FOOTE COMPANY, INC.

NUNDA, NEW YORK

FOOTE ENGINEERS

have kept pace with concrete road problems. The MultiFoote Paver is absolutely up to the minute—the latest thing in concrete pavers. When you are in the market ask about its 10 points of superiority.

World's Largest Exclusive Builders of Road Pavers

ADNUN BLACK TOP PAVER

FROM THE GREAT MULTI-SOL REFINERY COMES THE

New GULF-LUBE

The photograph above shows the quantity of carbon removed by the Conradson Carbon Residue Test when applied to a gallon of the new Gulflube Motor Oil and to a gallon of another widely distributed brand of motor oil. At the left is a partial view of Gulf's new Multi-Sol plant at Philadelphia.

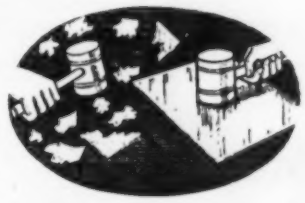
(Left) Fleet owners can now purchase this new premium quality Gulflube Motor Oil in drums at a moderate price. (The new Gulflube is the only motor oil made by a multi-solvent process and retailed at 25c per quart at service stations).

A Premium Motor Oil... in Everything but Price

WITHIN the past few weeks, many commercial car and truck operators have made a discovery that is saving them money...

They have discovered a medium priced motor oil that is equal to most premium oils... *and actually better than many!* It is the new Gulflube. And it owes its amazing quality to an utterly new refining process—the Multi-Sol process—which gets rid of the "mischief making" elements—tars, gum and carbon-forming compounds. No other motor oil made by this remarkable process is sold at its price.

The Multi-Sol process makes Gulflube *a premium oil in every respect.* This process literally separates the cream of the lubricating stock from the less desirable portions and, by the use of selective solvents, settles out the impurities. The cream of the oil is then thoroughly dewaxed and filtered—to form the finest motor oil ever offered at its price—Gulflube.



SEE WHAT HAPPENS when a piece of ordinary glass is hit with a hammer. Now see what happens to a piece of *Shatterproof* glass. That's the difference between a "brittle" oil and "shatterproof" oil—Gulflube. The former breaks under piston heat. The latter keeps its body and protects your motor.

NO OTHER 25c MOTOR OIL GIVES YOU ALL THESE QUALITY POINTS!

1. It is Multi-Sol processed.
2. Its already high mileage has been stepped up 20% to 25%.
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CONTRACTORS SAY - GIVE ME HUG FOR *fast* DIRT MOVING OPERATIONS

MODEL 87Q HUG ROADBUILDER

● *Equipped with special elevating grader and dirt body. Powerful 6-cylinder truck engine. Full Diesel power optional. Heavy duty transmission with 10 speeds forward, 2 speeds reverse. Special heavy duty; double reduction rear axle. Rugged 8-inch "I"-beam frame. Special ground-grip pneumatic tires. Passenger car ease of steering and Sponge-Aire seat cushion for easy riding. Equalized load distribution and many other features, including the famous Hug front-axle rocker action that enables Hugs to get over rough ground with greater speed and ease, without twisting and bending frame, radiator and hood.*

● Actual experience of many contractors proves beyond any question that HUG Roadbuilders offer the fastest and most economical dirt moving equipment in the whole heavy duty dump truck field. In fact, Hug Roadbuilders will move *more* yardage for *less* money whenever it is profitable to operate any type of equipment at all.

Hug Roadbuilders will speed up your operations — carry you through on schedule, and be ready to whip your next contract regardless of conditions because *Hug's roadbuilding experience is built into Hug Roadbuilder Trucks!* This is why Hugs are out in front of the whole dirt moving field.

Hug Roadbuilder trucks are not limited to one phase of roadbuilding work, but are flexible transportation units. When the grading is finished, they can be easily adapted to batch hauling to the mixer or from the central mixing plant. And, best of all, they operate with *equal economy* on dirt, gravel, rock or batch hauling.

Let your Hug dealer show you why Hug Roadbuilders lead the dump truck field. Or write us today and we will send you complete information on this or any other Hug model.

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520 CYPRESS STREET • HIGHLAND, ILL.

● *One of a fleet of 7 Model 87Q Hug Roadbuilders operated by James Spencer & Son Construction Company, Gilmer, Texas. Used on new location state highway grading work. These Model 87Q Hug Roadbuilders averaged 300 cubic yards of pay dirt per truck in ten hours on a one-mile haul.*

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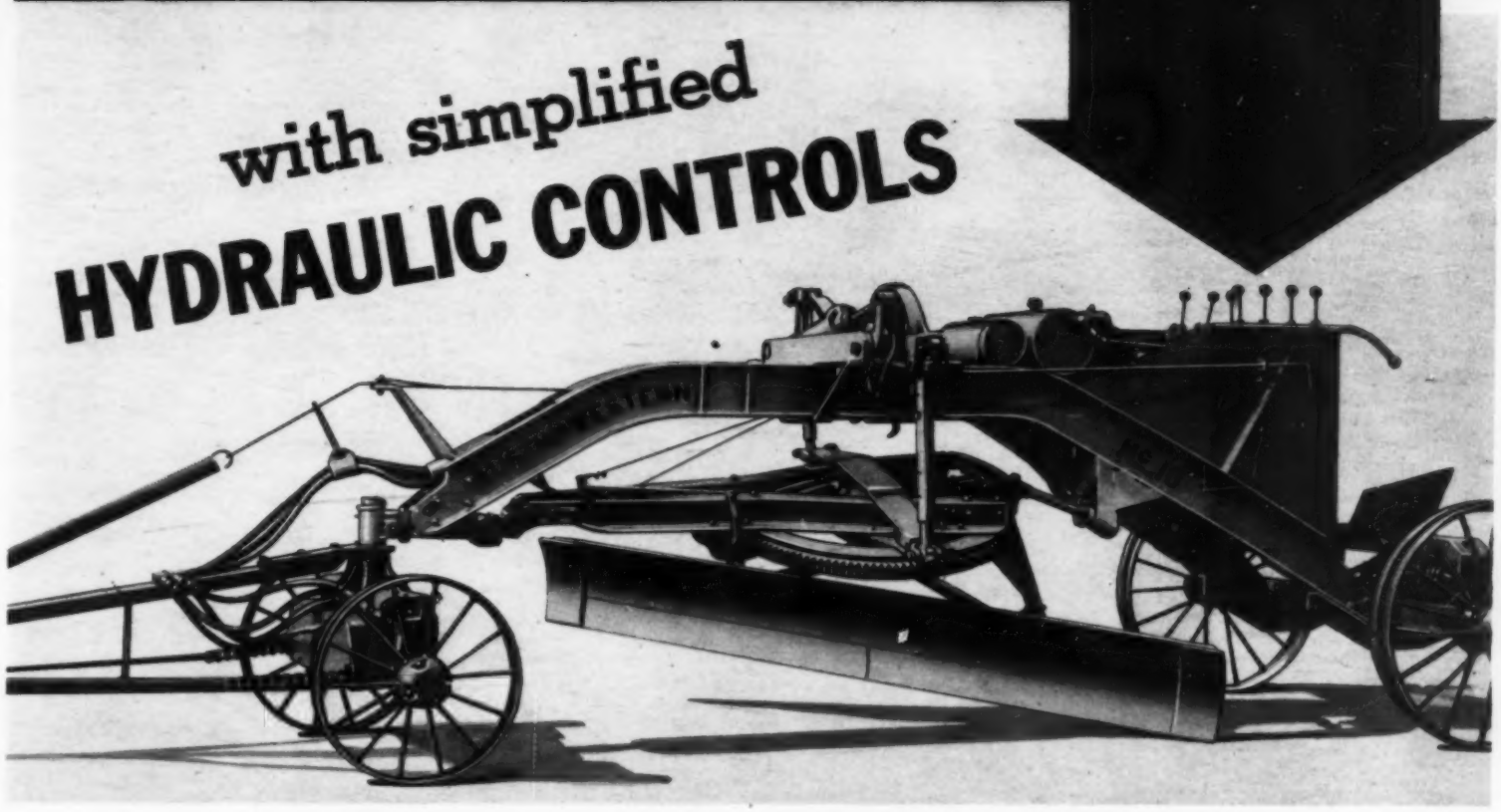
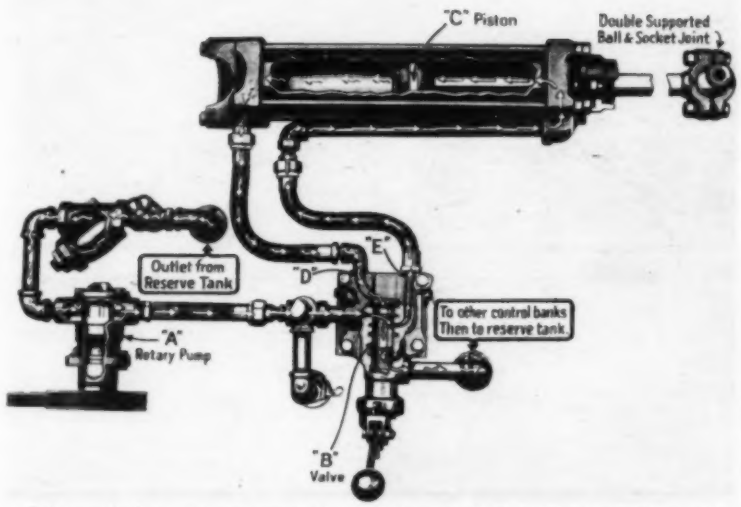
FASTER SIDE SHIFT
FASTER BLADE REVERSE

with simplified
HYDRAULIC CONTROLS





Oil travels from rotary pump A to sliding shaft B, set to divert the oil into the right hand of the cylinder, above, causing the piston C to move to the left. Movement forces the oil on left of piston to return to valve B. Valve may be shifted to reverse the flow or placed in neutral, locking the oil on either side of the piston at D and E. When flow is stopped at three points a firm wall of oil holds the piston in a vise-like grip, while oil from pump continues to flow freely through the valve.

● **The accurate and effective operation of the Nos. 10 and 11 Austin-Western Graders has been further developed by a new hydraulic side shift and circle reverse.**

With this improved control system the operator can now raise and lower, reverse and side shift the blade—lean front or rear wheels, shift frame on rear axle and steer, all by a touch of the control valves.

Anyone who knows blade graders will realize the time saved and the increased speed which must result when every mechanical operation is under instant and accurate control. Anyone who has bossed a job will know how energy saved the operator results in more efficient work.

Simplified hydraulic controls when combined with such outstanding design features as one-piece girder frame, direct draft from tractor to blade, and complete blade visibility make the Austin-Western Grader outstanding—the most economical buy for the man who must get results at lowest cost.

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The Austin-Western Road Machinery Co.
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Please send details on Austin-Western Blade Grader.

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IN kilns like these—longer than a residence lot, large enough to drive an automobile through, weighing more than a million pounds, largest pieces of rotating machinery in modern industry—Atlas and Universal portland cements are made.

When you buy these cements to build a road, or a dam, or a bridge, or a building, you know that you can't buy a better product, because Atlas and Universal portland cements fully meet the standards set by both the federal government and the American Society for Testing Materials.

But even so, we believe that our job includes more than *making* and *selling* good cement. We believe that it is part of our job to work with you in the *use* of cement. Not that we think we know more about construction than you do—we don't. But we have had the opportunity, in the thirty-odd years we've been in the cement business, to collect a lot of cement and concrete data from our friends in the construction field and from our own experiments and experience. And we learn new things each year in the same way.

So we simply say this—when you have a particular concrete problem on which you want accurate and current information, we'll be glad to hear from you. We think that this cooperation is part of our job—and while it doesn't go through those kilns, we make it an ingredient of every barrel of Atlas and Universal cement that goes to make good concrete. Try us out!

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United States Steel Corporation Subsidiary

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Construction Methods

NRA CODE

ROBERT K. TOMLIN, Editor

Established 1919—McGraw-Hill Publishing Company, Inc.

Volume 17—Number 7—New York, July, 1935

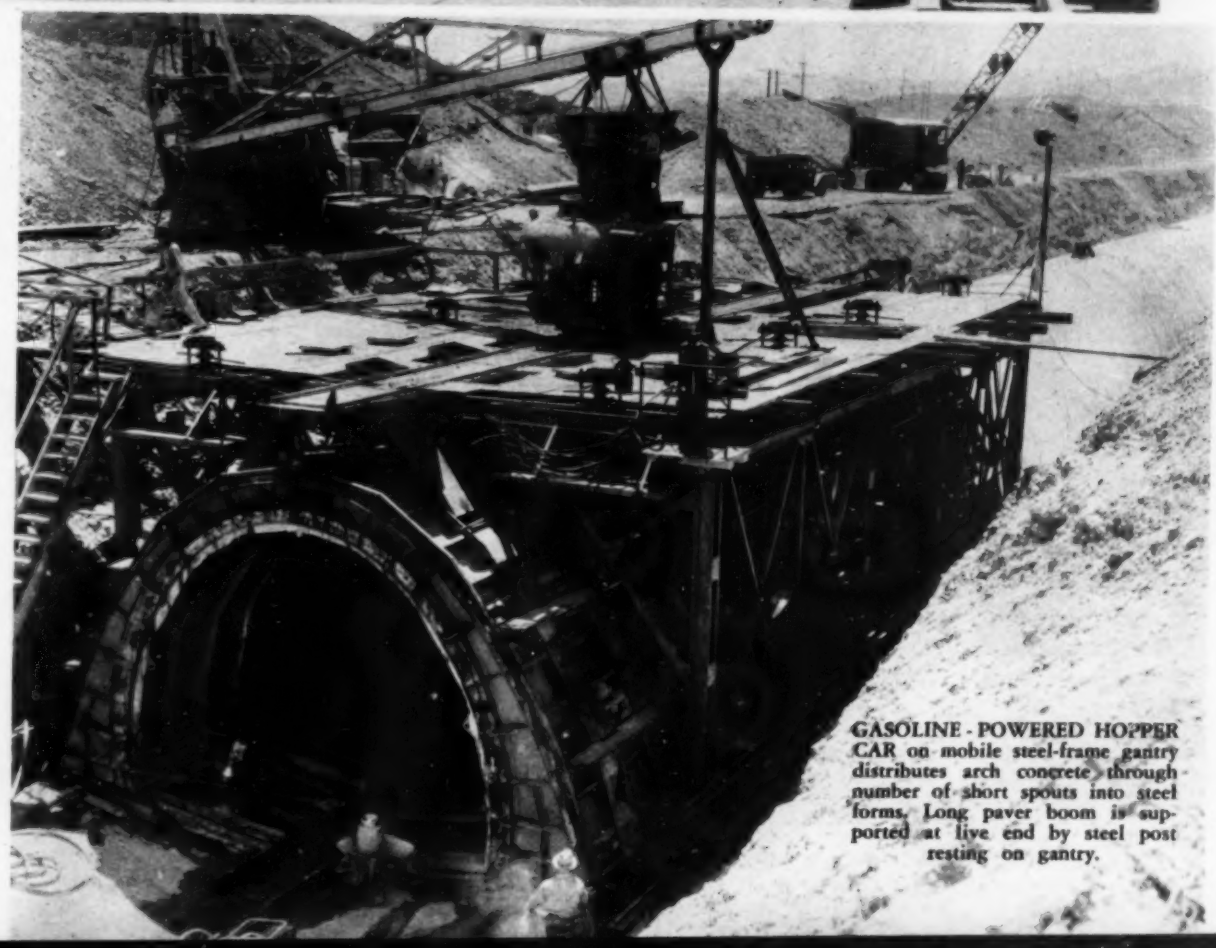
LONG-BOOM DUAL-DRUM PAVER

Concretes Colorado River Aqueduct

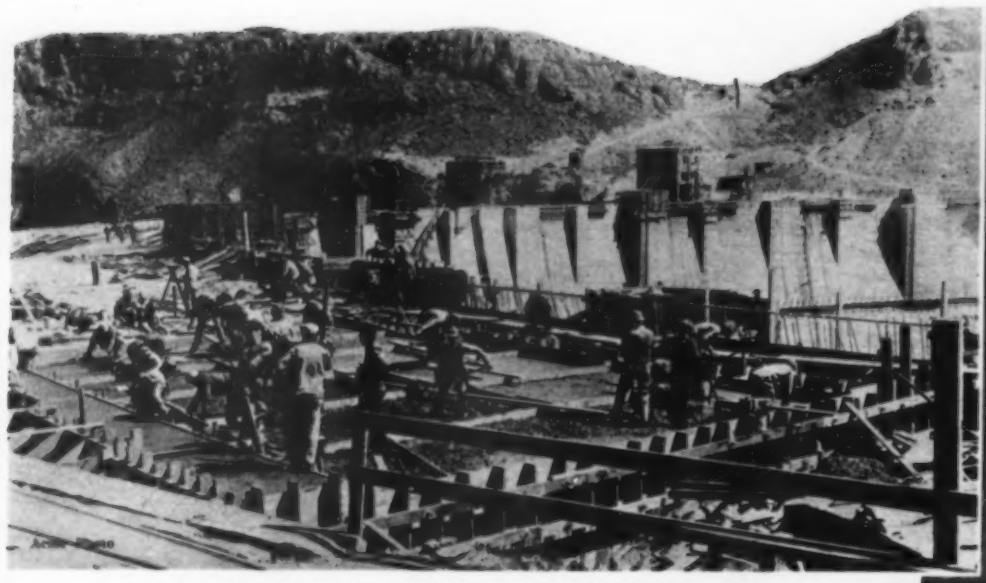
TRAVELING GANTRY BRIDGE carrying mobile trolley bucket distributes concrete across 29-ft. width of invert. Mixed batches are delivered by paver bucket to elevated hopper at one end of gantry bridge.

EQUIPMENT especially designed for the work is speeding construction of a section of reinforced-concrete conduit on the Colorado River aqueduct near Mecca, Calif., for Three Companies Inc., the contractor. A Ransome dual-drum paver traveling on the bank delivers mixed batches by bucket on an unusually long boom to two distinct types of distributing equipment, illustrated by the photographs, which place the concrete in invert and arch. Forms and mechanical equipment were furnished by the Ransome Concrete Machinery Co.

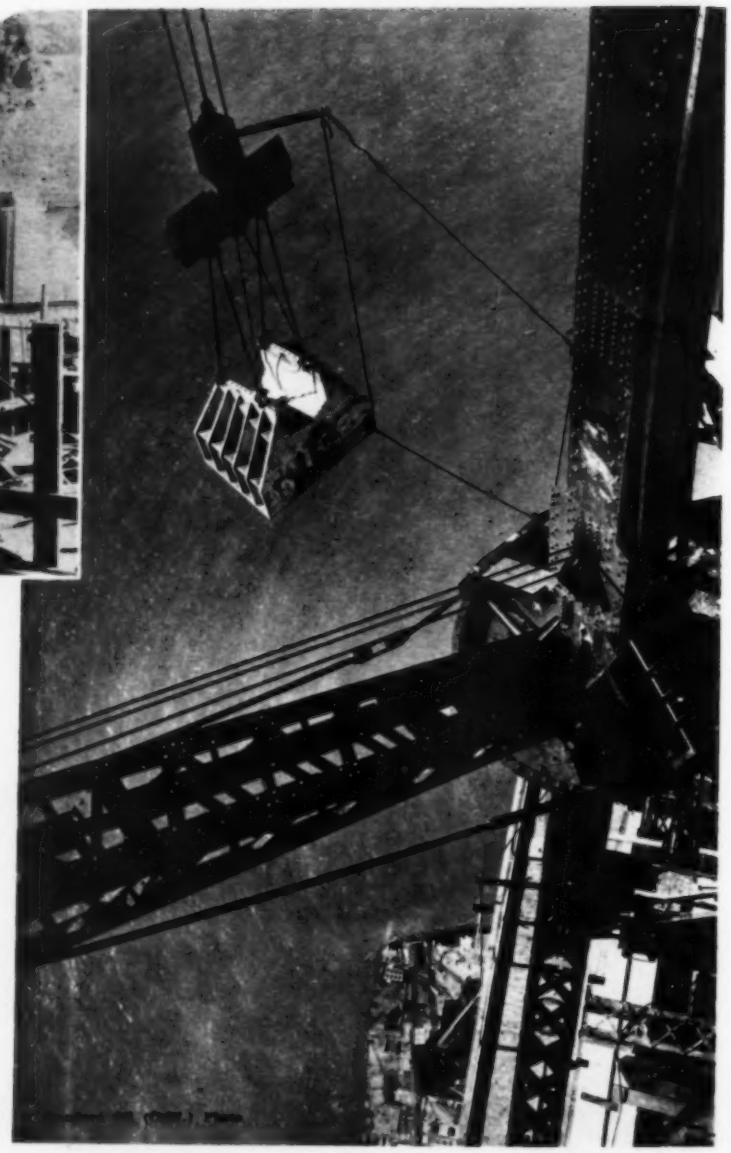
A 70-ft. length of arch, requiring a volume of about 200 cu.yd., is concreted in 3¾ hr. The job is equipped with 140 ft. of inside arch form and 70 ft. of outside arch form. As the field force can move and erect the outside form in 4 hr., the contractor has been able at times to complete 140 lin. ft. of arch, involving 400 cu.yd. of concrete, in 24 hr. The project is under the supervision of the Metropolitan Water District of Southern California.



GASOLINE-POWERED HOPPER CAR on mobile steel-frame gantry distributes arch concrete through number of short spouts into steel forms. Long paver boom is supported at live end by steel post resting on gantry.



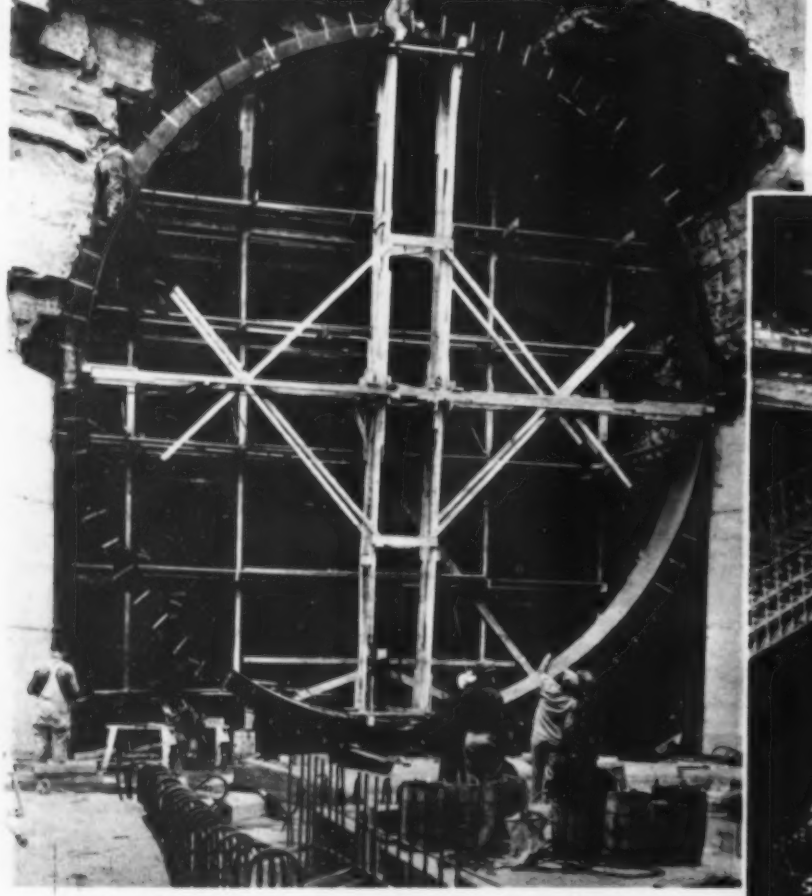
OVER THE TOP. Workmen of Six Companies Inc. build roadway along crest of Boulder dam on Colorado River after structure has been completed for U. S. Bureau of Reclamation to final height of 727 ft. above bedrock.



This Month's

"NEWS REEL"

GROOVED SADDLE UNIT, weighing 51 tons, is hoisted to place to carry 36½-in. diameter cable over top of tower of Golden Gate bridge, 4,500-ft. suspension span structure crossing San Francisco Bay. Saddle consists of three units with total weight of about 170 tons.



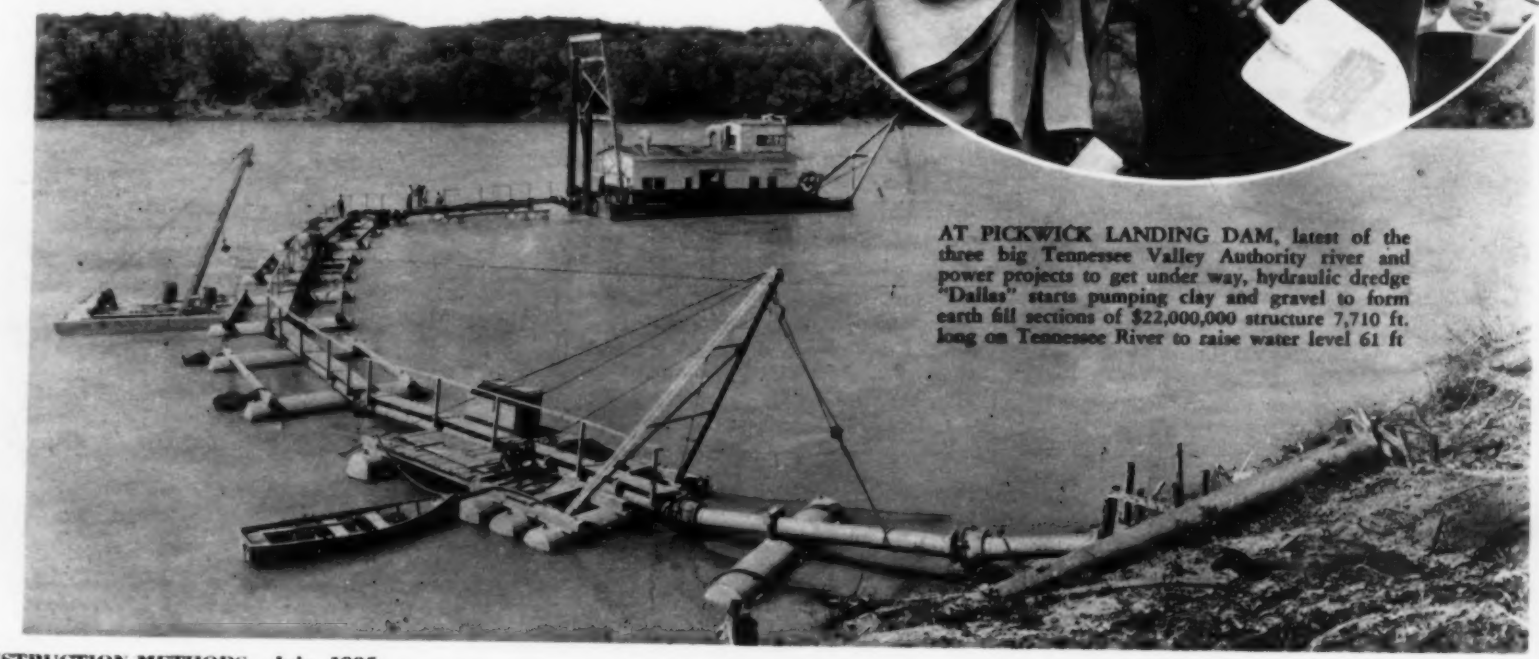
MIDTOWN HUDSON TUNNEL to carry cross-river vehicular traffic between New York and New Jersey is being built by Mason & Hanger Co., Inc., for Port of New York Authority with aid of PWA loan and grant. Subaqueous tube has outside diameter of 31 ft. and will carry 21 ft. 6 in. wide roadway. Present contract covers under-river portion of first tube of twin-tube project to cost $37,500,000. View shows portal ring assembly at New Jersey end of bore.

NEW 1,100-FT. PIER, one of three similar structures in Hudson River, New York City, included in $14,000,000 PWA project, is completed by Allen N. Spooner & Son, Inc., in time for docking of 79,000-ton, 1,029-ft. long French super-liner "Normandie," June 3, after her initial transatlantic crossing.

BRIDGES WIN BEAUTY AWARDS. As the most beautiful bridges built during 1934 the American Institute of Steel Construction's jury of prominent architects and engineers has selected the Bourne bridge *(below)* over the Cape Cod Canal in Massachusetts (in Class A, costing $1,000,000 or more) and the Douglas County bridge *(right)* near Omaha, Neb. (in Class C, costing less than $250,000). The Bourne bridge, comprising three spans of the continuous type, with an arch over the canal, was designed by Fay, Spofford & Thorndike, engineers, of Boston and was fabricated by the American Bridge Co. The Douglas County bridge, a grade separation structure, was designed by Guy Dorsey, assistant county surveyor, and was fabricated by the Omaha Steel Works. It is a deck arch separating the grades of two highways. Both bridges will be decorated with stainless steel plaques at appropriate ceremonies this summer.

CABLE SPINNING is begun on 1,380-ft. suspension span of Triborough bridge, crossing Hellgate section of East River, New York, between borough of Queens and Wards Island, off Manhattan. Contractor for cable suspension span, McClintic-Marshall Corp.

BETTER HOUSING DAY *(right)* is celebrated in Washington, D. C., as Joseph W. Byrns, Speaker of House of Representatives, delivers to Mrs. John S. Bennett, chairman, Women's Division of Better Housing Program, golden spade to break ground for housing projects in Capital.



AT PICKWICK LANDING DAM, latest of the three big Tennessee Valley Authority river and power projects to get under way, hydraulic dredge "Dallas" starts pumping clay and gravel to form earth fill sections of $22,000,000 structure 7,710 ft. long on Tennessee River to raise water level 61 ft

MELTING ICE CAKES

Lower 9-Duct Telephone Conduit in 500-ft. Sections Weighing 60 Tons

MELTING ice cakes, instead of jacks or chain and block tackle rigs, were the simple and effective means employed by the New York Telephone Co. to lower 3,200 lin. ft. of existing nine-duct vitrified clay conduit and two creosoted wood conduits at the southerly end of Flatbush Ave. opposite Floyd Bennett Airport in Brooklyn, N. Y. This underground conduit line, containing several large working cables, was laid originally in the year 1925 with its top about 30 in. below the surface of Flatbush Ave. Subsequent construction of the nearby airport has necessitated the repaving and regrading of the highway at a level from 3½ to 4½ ft. lower than the present surface, and a consequent depression of the buried telephone conduit along its westerly side. The material along the route is dry sand carrying no water at the level reached in excavating for this project.

When the problem of relocating the conduit at a lower level was presented it was decided to depart from the standard jacking and lowering methods hitherto employed on an operation of this sort and to support the 500-ft. sections of the line between manholes by blocks of ice which, melting gradually, would lower these 60-ton portions of conduit gently and uniformly to their new grade. The clay conduit, about 13½ in. square in cross section, consists of nine 3¼-in. square cable ducts and was originally laid in sections about 500 ft. long between manholes on a 4-in. base of lean concrete (1:4:8 mix) with a corresponding 3-in. concrete cover on top. The conduit is in 3-ft. lengths connected by dowel pins and cheesecloth and mortar joints. In relocating the line at its new grade it was necessary to lower the conduit from 2½ to 3½ ft., if possible without breaking the mortar joints or concrete base and top. The sequence of construction operations, which were used for the first time on work of this type, was as follows:

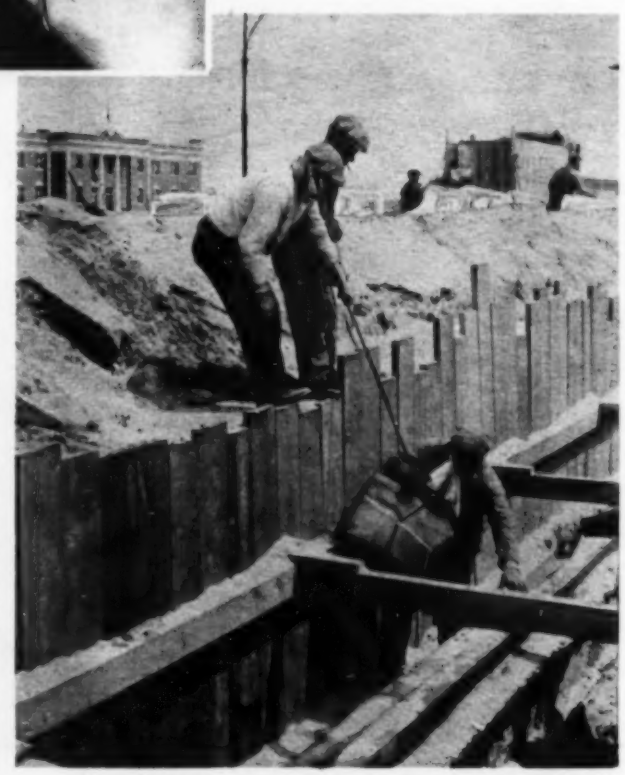
Between manholes a 500-ft. section of conduit was first uncovered by excavating in dry sand a trench 7 ft. wide, supported on the west side, adjacent to a city water department pipe line, with tight wooden sheeting and on the east side with skeleton sheeting. Digging was done by hand to a depth which exposed the 4-in. concrete base underneath the conduit line. Then, holes were excavated underneath the conduit at alternate joints to receive blocks of ice spaced on 6-ft. centers along the line. These ice blocks were placed by hand and brought up to a firm bearing against the under side of the conduit base by prying up their ends with the edge of a shovel and packing sand solidly underneath them.

When all of the ice blocks—approximately 83 in number in a 500-ft. section of line—had been firmly set, the sand in the trench bottom supporting the conduit between each pair was scraped out with shovels to a depth of

Photo, Rudy Arnold

ICE BLOCKS, embedded part way in sand and spaced 6 ft. apart, support conduit at every other joint. Wiring holds concrete base in place during lowering.


CONDUIT IS UNCOVERED by hand excavation, followed by sheeting of trench 7 ft. wide.


ICE WAGON on upper bank delivers cakes to side of trench from where they are lowered by rope for placing under conduit.

VERTICAL TIMBERS are nailed to cross-bracing to guide conduit in its descent to new lower grade.

about 7 in., thus leaving the line as a series of continuous 6-ft. bridge spans unsupported except by the ice block piers. As each ice block melted, the conduit line sank gradually and evenly, more sand being dug out, as required, until all of the ice blocks had completely melted. The ice cakes were thus kept partially covered prior to the final melting. This method prevented too rapid melting on the sides and concentrated the melting at the upper surface of the ice where the pressure from the weight of the structure was applied. Further lowering was effected by repeating the operations above described with a new set of ice blocks under alternate conduit joints.

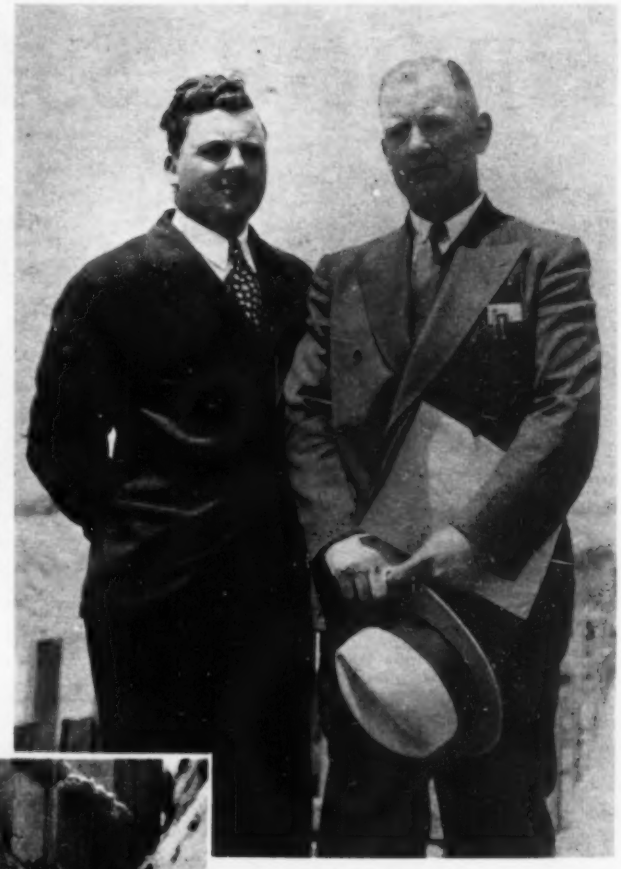
As delivered to the job the ice used for this conduit-lowering operation was the ordinary commercial product in cakes measuring 42 in. in length, 22 in. in width and 11 in. in thickness. For the maximum range of conduit lowering—42 in.—each ice cake was cut into two pieces measuring 21x11x22 in., two complete sets of ice blocks being required; where the line was lowered only 36 in., however, the cakes for the last 14 in. were split into three blocks, each 14x11x22 in.

Most of the lowering was done during the months of April and May at temperatures somewhat below normal for this season of the year in New York. Melting of the ice blocks occurred at a rate which completed 21-in. drops in about 58 hr. and 14-in. drops in about 48 hr. During the melting period the next section of trench was opened and the preceding section backfilled.

A detail which preceded the lowering operation was designed to prevent the cracking or breaking off of the layers of concrete forming the base and cover of the conduit line. At intervals of 6 ft. lengths of wire were passed around the structure and twisted up into tight loops to hold the concrete in place. Thus the base of the structure was preserved and the expense of placing a new concrete base course was avoided.

Another detail of the operation insured the proper alignment of the conduit during lowering. Before the ice blocks were placed wood planks were set vertically about every 12 ft. against each side of the conduit and nailed to the cross-bracing of the trench. When the lowering started, therefore, these planks guidec. the descent of the conduit in a true vertical line.

READY FOR LOWERING. *(Below and in oval).* As ice blocks under every other joint melt conduit descends slowly and evenly.



H. C. YOUNG, *(right)* supervisor of subway construction, and W. H. COFFEY, supervising foreman, North Brooklyn Division, New York Telephone Co.

BACKFILLING OF TRENCH over lowered conduit is done by scoop operated by cable from small air-hoist on portable compressor.

When the conduit had been lowered to its new grade the trench was backfilled economically by a scraper bucket pulled across the line by a cable from an Ingersoll-Rand air hoist mounted on a Chicago Pneumatic portable compressor. The backfilling operation required a crew of three men, two on the handles of the scoop and one on the air hoist. With this equipment the crew backfilled the trench 7 ft. wide and about 8 ft. deep at the rate of about 25 lin.ft. per hour.

Obviously an important consideration in any scheme for lowering a telephone conduit of this type is the matter of preventing the breaking of joints in the line. Methods formerly used had involved the use of jacks and blocking or of chain blocks supporting the structure at numerous points with slings and lowered simultaneously by a long line of workmen. The melting ice block method, however, was found highly efficient in its non-breakage of conduit joints and required a minimum outlay in the equipment and materials necessary for its operation.

For the New York Telephone Co. the work was handled by the regular construction forces of the North Brooklyn Division, of which A. Schaper is construction superintendent. In immediate charge of field operations was H. C. Young, subway construction supervisor, who worked out the details of the melting ice method, W. H. Coffey, supervising foreman and J. J. Spinella, foreman.

PROGRESSIVE COFFERDAMMING

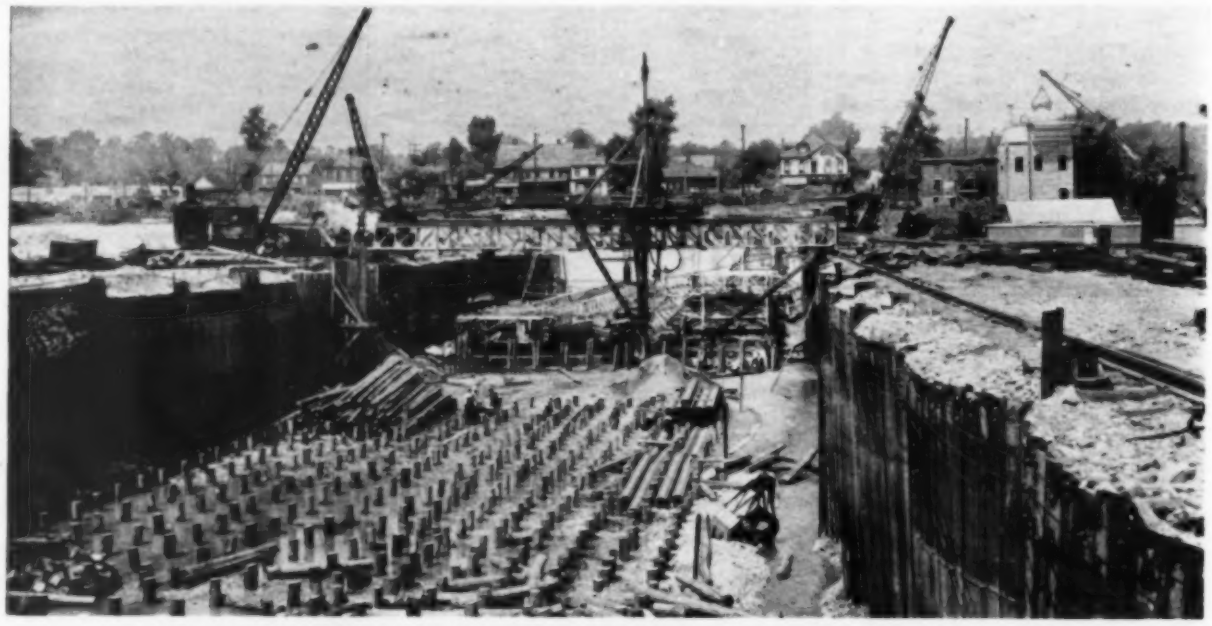
Speeds Work on Allegheny River Dam No. 3

SAND AND GRAVEL FILL for cofferdam cells is excavated from river bed by derrick boats operating 2-yd. clamshell buckets.

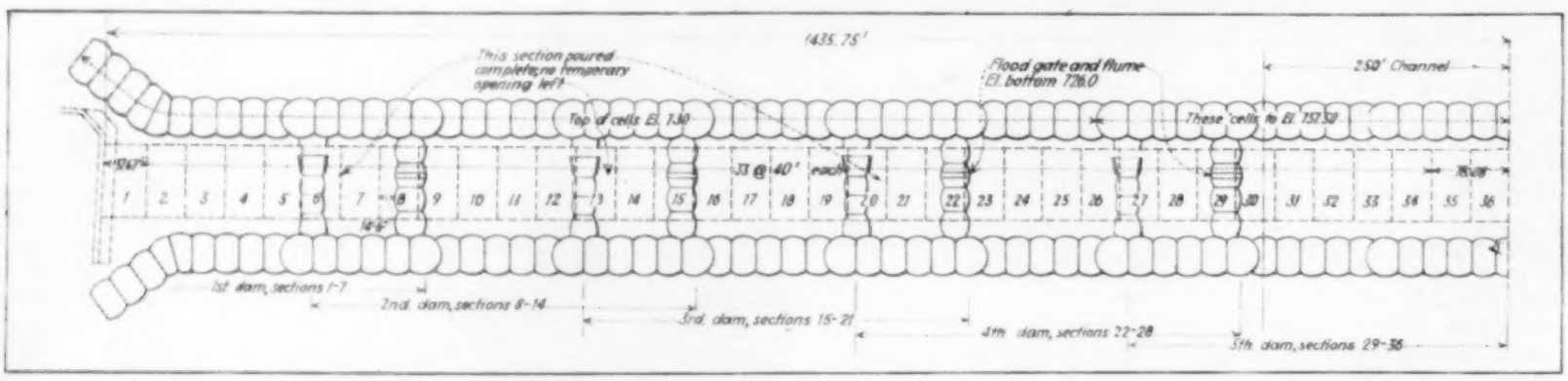
UTILIZATION of five cofferdam sections instead of the customary three enabled Seeds & Derham, experienced railroad, dam and bridge contractors, of Philadelphia, to maintain practically continuous employment of the various construction crews needed to build Allegheny River Dam 3, at Cheswick, Pa., 10 mi. north of Pittsburgh, on the firm's first river contract with the Corps of Engineers, U. S. Army. Continuity of operations was relied upon to yield eventual economy in spite of a higher first cost for sufficient sheetpiles to carry out a progressive cofferdamming procedure. Thorough planning, skillful layout of the job and development of special equipment for piledriving won the ungrudging respect of seasoned river contractors who bid on the same project. A mobile piledriver mounted on a traveling gantry bridge (which spanned between the upstream and downstream arms of the cofferdam) drove hardwood piles and sheetpile cutoff walls for the dam foundation faster than other rigs previously used on similar work.

Awarded the contract for a dam 1,436 ft. long and 28½ ft. high on Nov. 4, 1933, at a bid price (based on estimated quantities) of $830,579, with a time allowance of 485 calendar days to complete, Seeds & Derham planned their operations to finish the work well within this period by employment of two 5-hr. shifts for 7 days each week, leaving only routine duties to be performed by a small night force. Accompanying drawings indicate the design and dimensions of the structure, which was built with a PWA allotment. The Allegheny River is a troublesome stream with which to deal, especially on a contract that runs through two winters and only one summer. During the first 15 months on this job the river reached flood stage eight times.

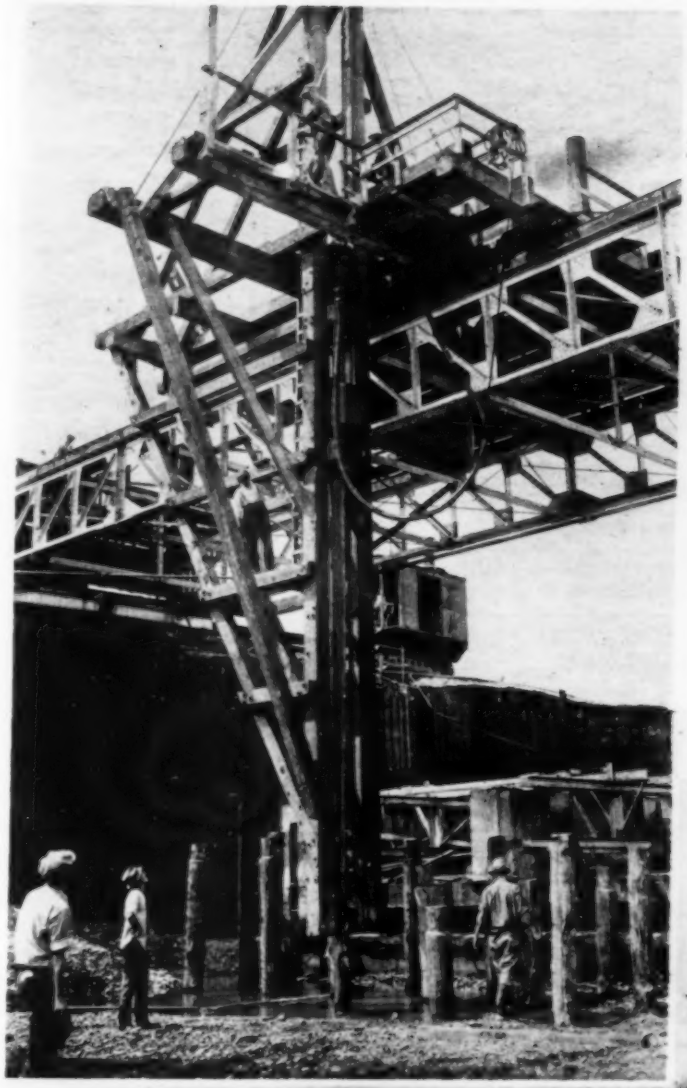
Cofferdam—Two light, mobile floating derricks with long booms drove the steel sheetpiles for the cells of the cofferdam around a floating, single-deck templet. The contractor purchased 4,100 tons of Carnegie M-112 shallow arch-web piles weighing 30.7 lb. per linear foot of pile and 23.0 lb. per square ft. of wall for the cofferdam construction. Each cell measured 40 ft. 1⅞ in. outside to outside of curved walls (drawn on a radius of 25 ft. 5¾

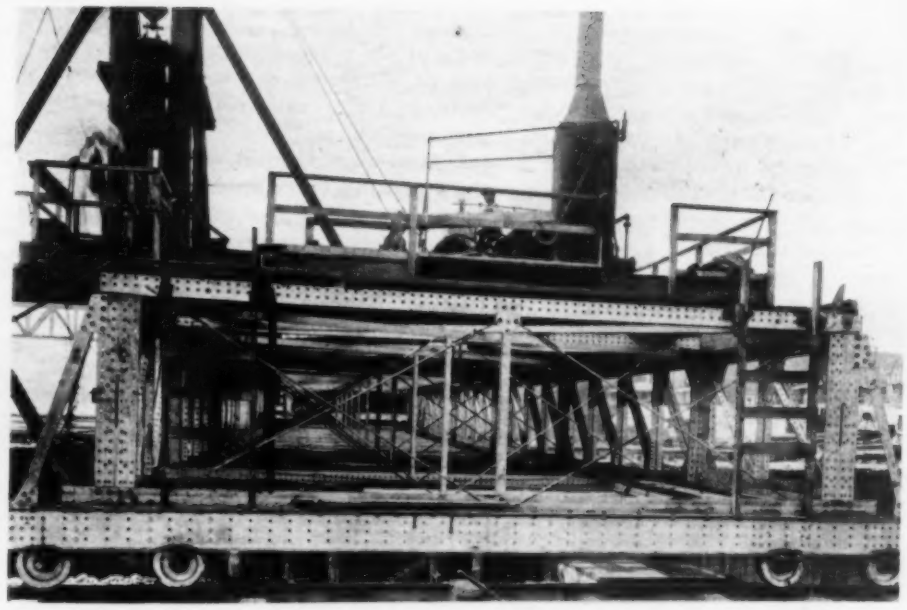


4,420 HARDWOOD FOUNDATION PILES averaging 17 ft. long are driven by mobile gantry piledriver mounted on steel truss bridge which spans between upstream and downstream walls of cellular sheetpile cofferdam.

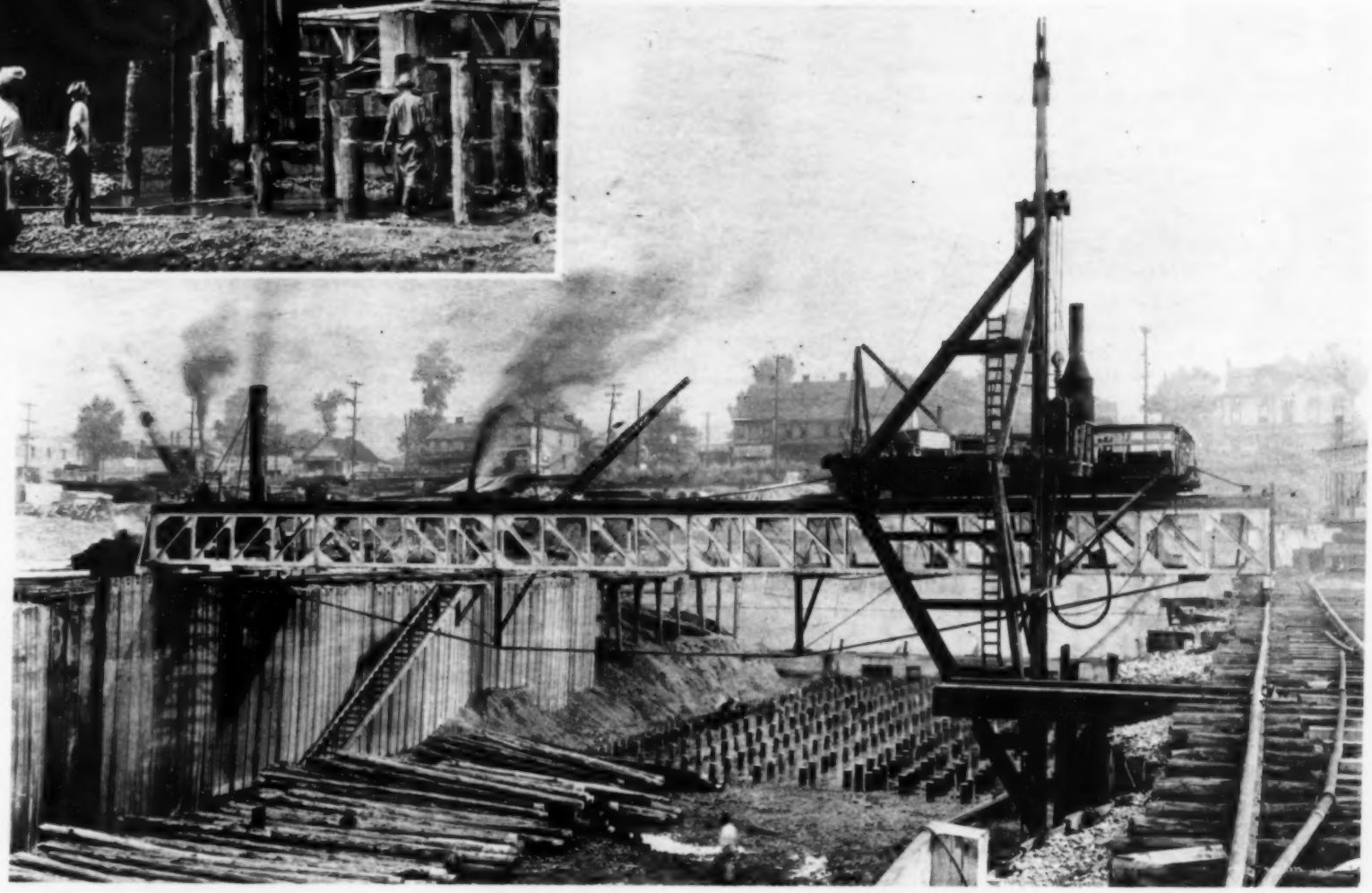


PROGRESSIVE COFFERDAM CONSTRUCTION in five sections enables dam builders to carry operations in unbroken sequence from abutment at left to connection with river wall of lock at right. Following completion of dam concreting in each section, contractor constructs temporary bulkhead across completed structure to permit removal of cross-coffer wall. Alternate blocks of dam in first three cofferdam sections were omitted temporarily (except as noted on drawing) to pass flow during construction of last section.





TRAVELING GANTRY PILEDRIVER consists of mobile carriage on rolling steel bridge of 107-ft. span. Carriage supports two steam hoist engines and offset hammer leads. Steam for hammer is supplied from boiler at downstream end of gantry bridge. Rig drives steel sheetpiles in permanent cutoff wall under upstream edge of dam *(below)* and puts down timber foundation piles *(at left)*. Trusses *(above)* are made up of steel angles and turnbuckle tierods.



in.) and 25 ft. 5¾ in. between axis lines of diaphragms. Piles in the outside walls were 50 ft. long and were driven to rock; the inside-wall piles and diaphragm piles penetrated into the sand and gravel bed of the river to 10 ft below grade. The piledriving crews did a workman-like job of cofferdam construction, and the structure gave evidence of good alignment in both horizontal and vertical planes. Several features of the equipment contributed to this result.

Designed for fast setting and driving of light pile sections, each of the floating steel stiffleg derricks was mounted on two wooden pontoons of adequate buoyancy constructed on the job for this temporary service. A pontoon about 18x60 ft. in deck dimensions carried the steam hoist engine and counterweights of each unit, while a smaller pontoon supported the mast. One derrick had a 105-ft. boom, and the other had an 80-ft. boom.

Once the Y-piles at the corners of a cell had been spotted, the threading and driving of the wall and diaphragm piles proceeded rapidly. As an aid to the latter operation the contractors used a simple and ingenious guide for the steam hammer. A steel beam of 5-in. H-section was hung by whip line from the boom of the same derrick which handled on its hoist line a McKiernan-Terry No. 7 hammer used for driving. At the lower end of the H-beam was a chain and hook by which the beam was attached to a pin in a driven pile alongside the pile to be driven. Taking a strain on the whip line, the derrick held the H-beam in vertical position to serve as a guide for the hammer.

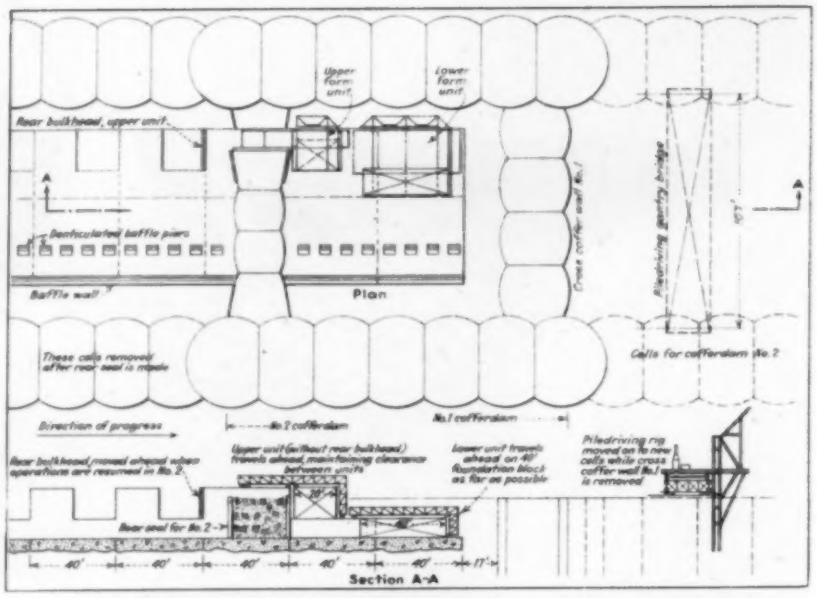
Sliding guide plates attached by stud bolts to the hammer engaged the flanges of the H-beam and directed the travel of the hammer in a vertical path. The device kept the piles vertical and eliminated need of swinging leads and guy lines. It was easily detached and transferred to position for driving the next pile.

Two derrick boats using 2-yd. clamshell buckets excavated inside the cofferdam and filled the cells with sand and gravel. When this excavation had been carried close to final grade and

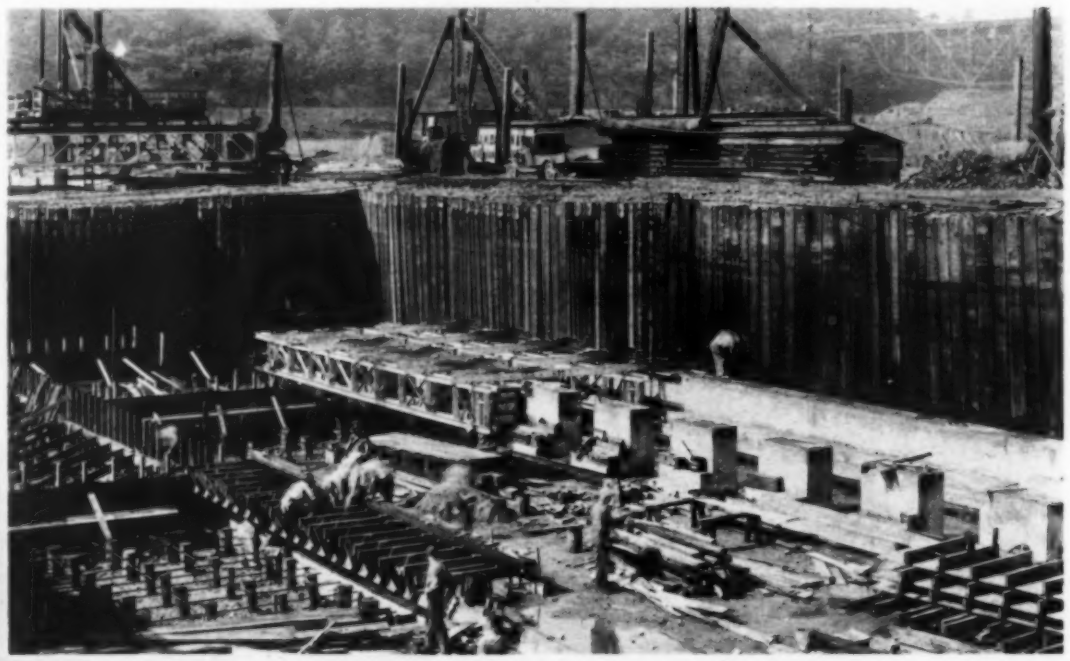
the cofferdam closure had been made, three Sterling deep-well turbine pumps, with 10-, 12-, and 14-in. discharges and a total capacity of 12,000 g.p.m., unwatered the inclosed area in 2 or 3 days. When the dam in one section of coffer had been completed, the steel forms for two lifts of concrete were stored at the outer end of the completed dam section, and a bulkhead of steel-pile cells was constructed behind them between the walls of the cofferdam, tying into the completed dam. As indicated by an accompanying drawing, the bulkhead was sealed against any infiltration under the dam by a cutoff wall of steel sheetpiles driven to rock and anchored in the base concrete of the dam and apron. This bulkhead formed the end closure for the new section of cofferdam. After the new section had been unwatered the steel piles of the old end wall (now inclosed by the new coffer) were withdrawn, and the construction of the dam proceeded through the length of the new section. These operations were repeated, with necessary modifications, for the five sections of the dam, each about 300 ft. long.

Gantry Piledriver—Traveling on the cofferdam behind cranes which cleaned up the bottom of the excavation to final grade the mobile gantry piledriver began installation of timber foundation piles and steel sheet cutoff piles. This rig consisted of a movable carriage (mounting a boiler, two steam engines and a pair of offset timber leads) running on a traveling deck-truss gantry bridge which rolled at both ends on steel rails laid on the cofferdam. The steel bridge was designed and built by the Blaw-Knox Co. in accordance with plans suggested by the contractor to carry a 30-ton concentrated load at the center of a 107-ft. span. Made up of two trusses 5 ft. 3⅜ in. deep spaced 20 ft. apart, the bridge later was strengthened by the contractor by the addition of two hog rods, increasing the capacity to 44 tons safe loading at the center of the span.

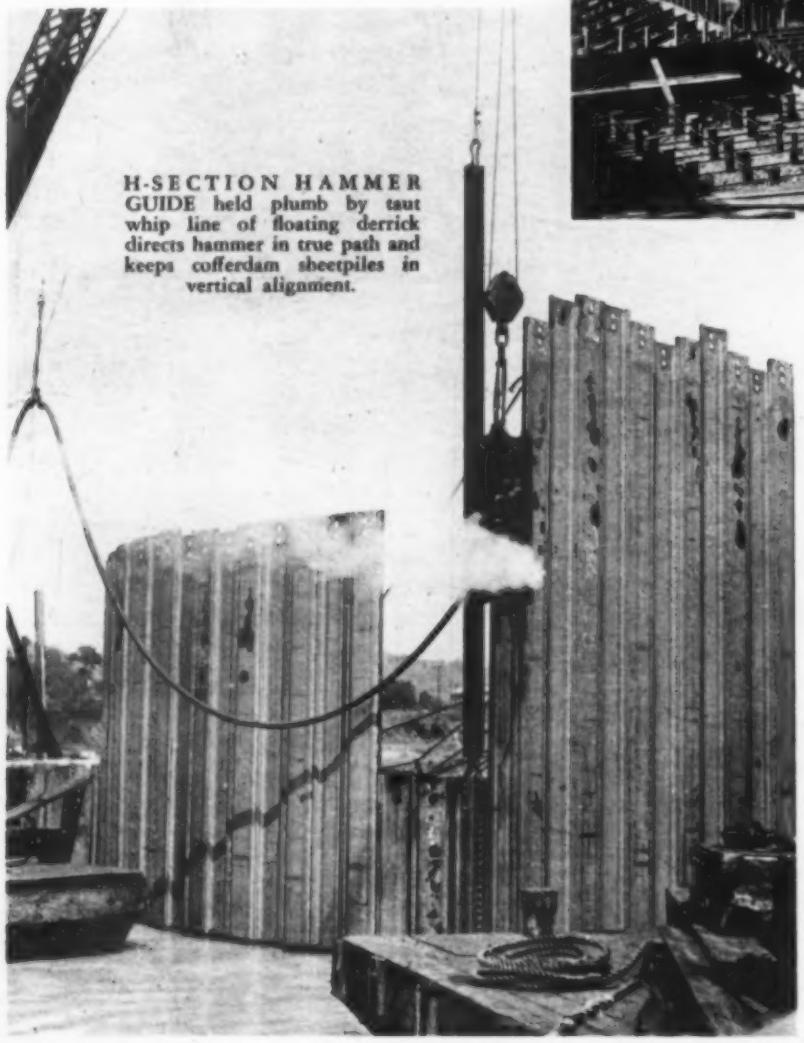
At both ends the gantry bridge traveled on a single rail, but on the downstream wall of the cofferdam a second rail was required to carry the hammer boiler, which rested on a platform attached to this end of the bridge. The piledriver carriage on the bridge was moved back and forth on two rails set



TRAVELING STEEL FORM UNITS are stored at end of completed dam section pending construction of temporary bulkhead and removal of cross-coffer wall.



ROLLING GANTRY FRAME carries steel forms for baffle wall and denticulated baffle piers on concrete apron of dam.

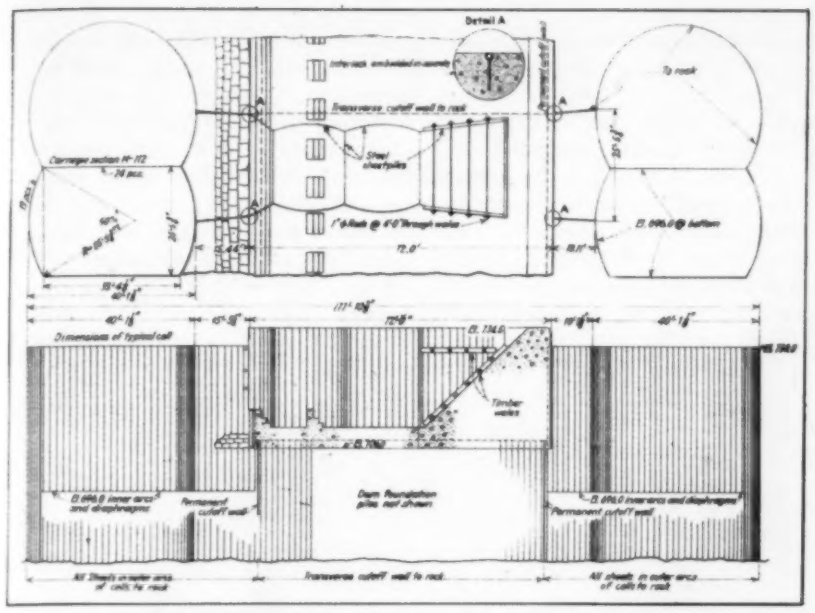


H-SECTION HAMMER GUIDE held plumb by taut whip line of floating derrick directs hammer in true path and keeps cofferdam sheetpiles in vertical alignment.

at 20-ft. gage by a single-drum steam winch which had wound on it several loops of a ⅜-in. cable anchored at both ends to the extremities of the bridge. This winch was supplied with steam by the same boiler which operated a Mundy three-drum hoist engine mounted on the carriage. Only two of the hoist drums were used; one drum operated the hammer hoist line and the second operated a whip line for snaking and setting piles.

A set of ordinary wooden piledriver leads was suspended in inverted position on cantilevered timbers at one side of the carriage, clear of the bridge truss. These leads were provided with a short timber extension above the level of the carriage deck and were rigidly secured with adequate timber bracing. A jib, or outrigger, on the timber leads picked up steel sheetpiles for the cutoff walls. The hammer used for driving sheetpiles was provided with bolted guides which enabled it to drive these piles in an offset position, as the timber leads would have fouled a sheetpile set between them.

Painted marks on the single rail under the upstream end of the bridge indicated the proper setting of the piledriver to install timber piles in transverse rows, spaced on 4-ft. centers. The bridge itself was marked for the positions of piles in each row, 4 ft. 2 in., c. to c., and also for the steel sheetpile cutoff walls under the upstream heel and down-stream toe of the dam. In all the gantry rig drove 4,420 hardwood piles averaging about 17 ft. long for the dam foundation and 3,080 lin. ft. of steel cutoff walls. Under the upstream heel, the cutoff piles were driven to rock, but under the toe of the apron the design called for sheetpiles only 17 ft. long to prevent scour. In both walls, the contractor placed Carnegie M-106 deep-arch piles. A Vulcan No. 1 single-acting steam hammer drove the timber piles, and a double-acting McKiernan-Terry No. 9 (with offset guides) drove the sheetpiles.



STEEL SHEETPILE BULKHEAD seals end of cofferdam section to permit removal of cross-coffer wall. Transverse cutoff wall is driven in advance of dam construction. Cellular design is used for remainder of bulkhead.

Without forcing, the gantry piledriver several times installed 110 wood piles in 10 hr., an average of 5½ min. per pile. Of this time it is estimated that about 1½ min. was required to set the piledriver and pile in position and 4 min. to drive the stick. The piledriver easily kept ahead of the concrete crew, averaging 85 timber piles per day. Because a change of hammers was involved, the gantry rig ordinarily drove wood piles and steel sheetpiles on separate shifts.

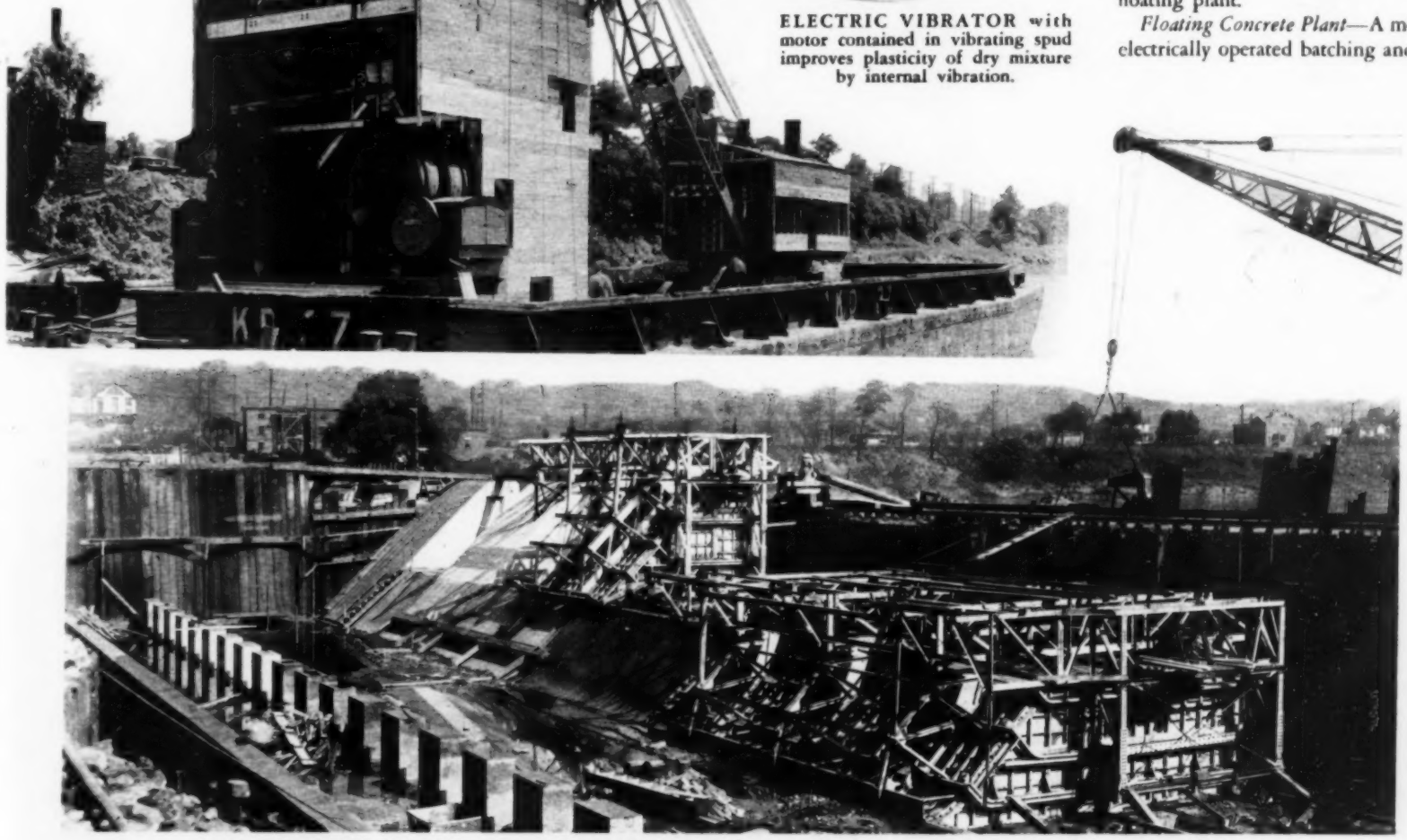
Concrete — Wood forms were used to place a 6-ft. thickness of concrete for the apron and for the bottom lift of the dam. Two steel forms were required to place the remaining concrete in the dam in two lifts. In addition, a third set of steel forms was used to cast the baffle wall and denticulated piers of the apron. All the steel forms were built by the Blaw-Knox Co. at its plant 4 mi. below the dam. Dam 3 is the first Allegheny River structure to incorporate a second baffle of the denticulated type, designed to reduce the velocity of the overflow and thus diminish scour. A rolling gantry frame carrying forms for both baffles traveled on rails laid on the apron. The steel forms for the two lifts of the dam also traveled on steel rails, laid on the next lower lift at the forward end and on the completed lift at the rear end. The lower lift of steel form, which was 40 ft. long, required the largest monolithic concrete placement on the work, 385 cu.yd. For the first 800 ft. of dam, a 20-ft. steel form for the upper lift was used to cast alternate 20-ft. blocks with 20-ft. openings between them. These openings, aggregating 400 ft. in length, passed the flow of the river during the construction of the last section. After the casting of 20-ft. blocks had been completed, the contractors used the same form to build the upper lift continuously.

Concrete for the dam was batched and mixed by a floating plant which moved along the cofferdam as the work advanced. The concrete mixture was based on 1:1.72:5.76 volume proportions and included three sizes of coarse aggregate of maximum 6-, 4- and 2-in. size. Stated in dry weights for a 1-yd. batch, the proportions of the concrete ingredients were 825 lb. of sand, 730 lb. of small gravel, 730 lb. of medium gravel, 1,200 lb. of large gravel, and 435 lb. of cement. These weights had to be adjusted for the larger batch mixed by the 1½-yd. mixers of the floating plant.

Floating Concrete Plant—A modern, electrically operated batching and mix-

FLOATING BATCHING AND MIXING PLANT mounted on spliced steel hulls moves along cofferdam as work progresses.

ELECTRIC VIBRATOR with motor contained in vibrating spud improves plasticity of dry mixture by internal vibration.



TWO SETS OF TRAVELING STEEL FORMS build upper lifts of dam above base concrete. In first 800 ft. of construction, alternate 20-ft. blocks are omitted from final lift. Baffle wall and baffle piers on apron appear in left foreground.

ing plant characterized by automatic control of many production operations was mounted on a pair of spliced steel hulls which also carried a Wiley steam whirley with a 75-ft. boom which charged the overhead aggregate bins from supply barges with a 1-yd. clamshell bucket. Bulk cement was transferred to a 100-bbl. overhead bin by a Fuller-Kinyon conveying system from a covered barge of 2,300-bbl. capacity. One set of Blaw-Knox batching equipment fed two Ransome 1½-yd. mixers. The proportioning equipment (of 2-yd. size) was operated by one man with pushbutton control of all functions except aggregate batching, which the operator took care of with manually-thrown levers. An automatic cement-weighing batcher of screw-feed type, an automatic water weighing and measuring tank, and a springless dial scale for four classes of aggregate metered the concrete ingredients. Mixer batch-meters were set for a 1½-min. mixing period.

Mixed batches discharged from the mixers into 1½-yd. roller-gate buckets which were handled into the forms by a Wiley steam whirley with an 85-ft. boom traveling on the cofferdam. These buckets were built up from standard Blaw-Knox 1-yd. buckets by adding an 18-in. extension to give the required greater capacity while keeping the diameter small enough to go inside the crest form on the dam. The dam and abutment called for a mass of 46,000 cu. yd. of concrete.

Concrete Vibration — All concrete was vibrated internally with Jackson electric spud vibrators mounted on rigid pole handles and operated at a minimum frequency of 3,600 r.p.m. An average slump of 1¾ in., with an average water-cement ratio of 0.733, was maintained. Up to the time when 75 per cent of the concrete was in place, the 28-day cylinder tests had averaged 4,200 lb. per square inch. Tests of 6-in. cores, drilled from completed monoliths, confirmed the test cylinder data. Considering that only 435 lb. of cement entered into each cubic yard of concrete, it may be said that the reduction in water-cement ratio made possible by effective placing methods (with vibration) caused an increase of about 1,000 lb. per square inch in the 28-day cylinder strengths over what might have been expected with unvibrated concrete.

Vibrators were used to break down the harsh mass of concrete as it was deposited by the bucket and were operated also along the face of the forms. As a result of the latter practices, the exposed concrete surfaces are unusually free from honeycomb. Numerous small pits or pockmarks, however, were found on exposed surfaces placed against steel forms. This condition may have resulted from segregation of small air bubbles against the steel forms, through which they could not escape.

Excessive vibration brought a surplus of paste and water to the surface of the concrete. Vibration of wet concrete produced similar results. The contractors found it advantageous to use two vibrators in placing the 1½-yd. batches of concrete. A spare vibrator was kept on hand at the forms to replace a disabled unit in any of the rare cases of breakdown.

A concrete gang of six to eight men scattered the concrete with shovels as the batch was dumped. Vibrators alone could not be relied upon to spread the concrete, as this service required excessive vibration, with consequent segregation. A vibrator was left in place in the concrete only about 10 sec.,—just long enough to sink in the mass and come out again slowly, giving the concrete opportunity to fill the void left by the vibrating spud.

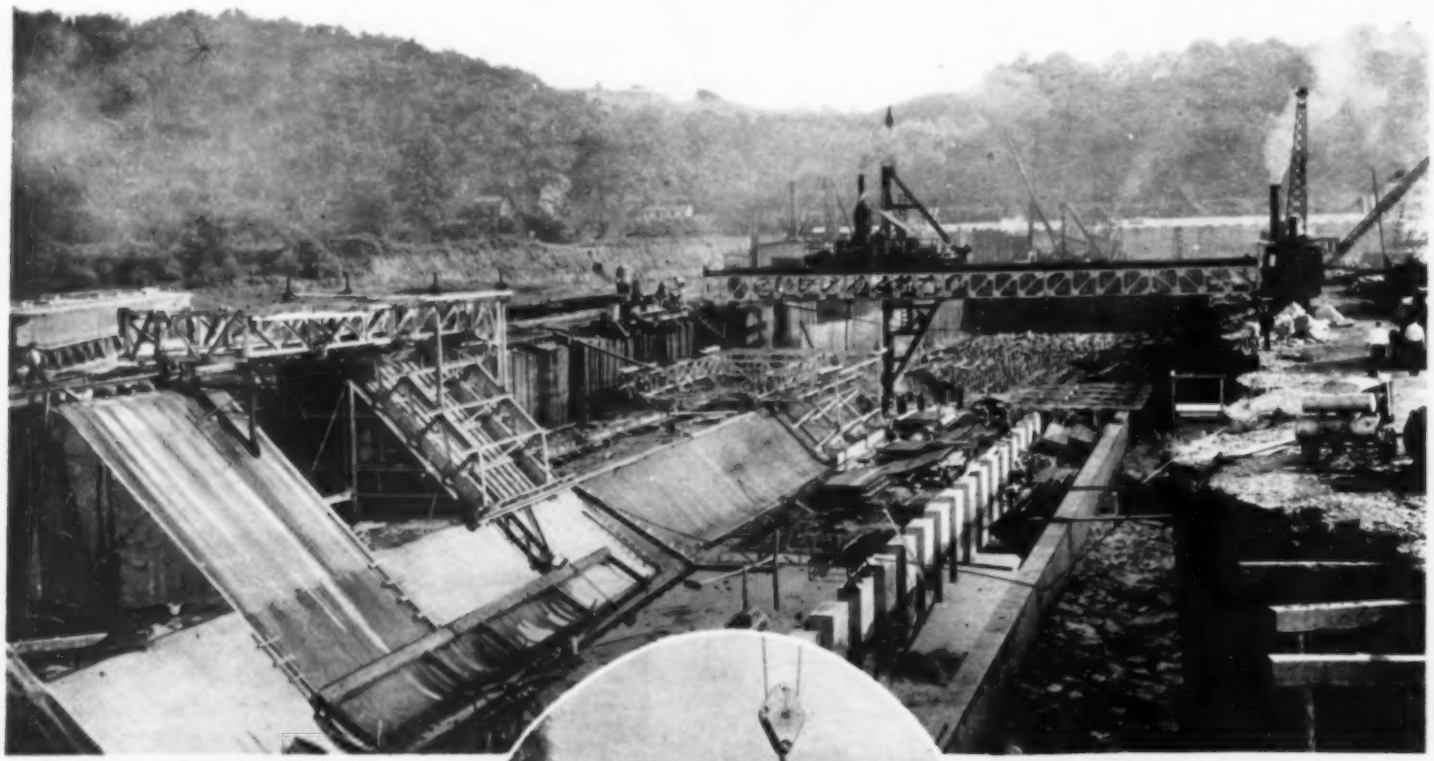
Winter Work—During December, the contractors placed 8,100 cu.yd. of concrete in 26 days of pouring, in spite of three severe cold spells during the month. For cold-weather concreting, the three sections of steel forms were completely housed over, and the concrete was cured in the presence of live steam. On the floating mixing plant, two boilers heated the water and four aggregates. Temperature of the concrete as it left the mixer was about 85 deg. F.

Supplemental Work — Additional equipment employed on the cofferdam included an Industrial-Brownhoist 15-ton steam crawler crane, an Orton & Steinbrenner 12-ton crane, and an Erie 6-ton crane (for placing derrick stone at the downstream toe of the apron). To handle yard work the contractors operated an Ohio locomotive crane.

Fourteen Mile Island is bisected by the dam. Specifications required the moving and placing of 200,000 yd. of sand and gravel on the island to prescribed contours. Two 3-yd. steam dipper dredges and two Bucyrus-Erie shovels, with 1½-yd. and 1-yd. dippers, handled the excavation. Along the north bank of the river, behind the abutment and adjacent to it, a traveling stiff-leg derrick placed riprap.

Personnel—Allegheny River Dam 3 was built with a PWA allotment by the Corps of Engineers, U. S. Army, from plans prepared by the district office, Pittsburgh. Maj. W. D. Styer, district engineer, was in general charge of design and construction. Operations at the site were directed by C. H. Wagner, resident engineer.

For Seeds & Derham, of Philadelphia, the contractors, William Lynch was general superintendent at the job, Samuel D. Ashworth was superintendent, and P. C. Olin was field engineer.

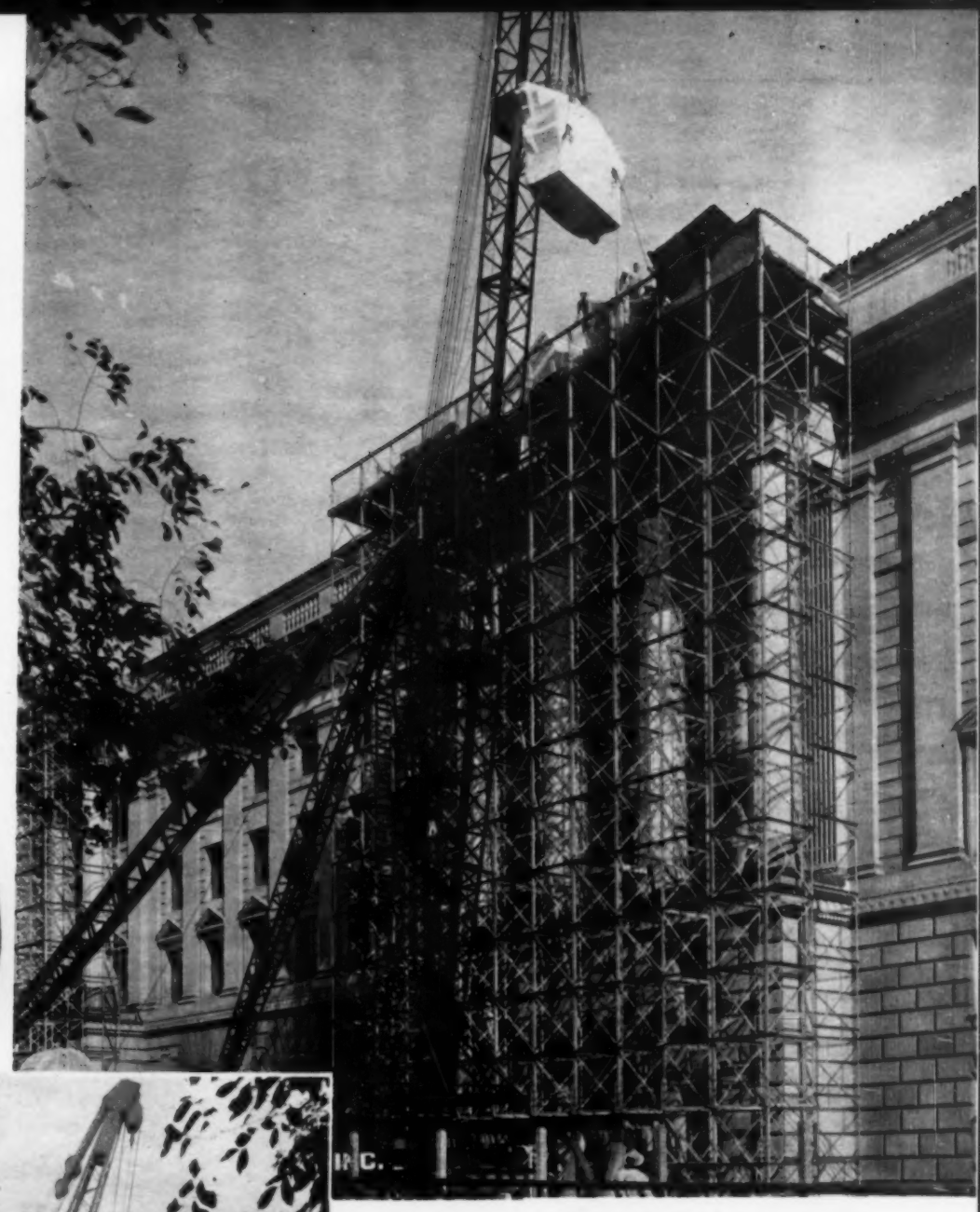


PROGRESSIVE OPERATIONS in dam construction. Gantry piledriver puts down foundation piles at far end of cofferdam. Following placing of 6-ft. slab on these piles, various steel forms serve concreting of dam and baffles. In distance, floating derricks drive steel sheetpiles of next cofferdam.

ROLLER-GATE BUCKET *(at left)* of original 1-yd. size, built up to 1½-yd. capacity by adding 18-in. extension at top, places concrete in narrow wall form.

MOBILE STIFF-LEG DERRICK

Places Heavy Pediment Stones



TRAVELING STIFF-LEG DERRICK with 130-ft. boom places pediment stones weighing up to 30 tons each above four 15th St. entrances of Department of Commerce Building in Washington, D. C. Steel scaffold supports working platform for stonesetters.

MOUNTED ON RAILWAY TRUCKS mobile erecting unit moves from one entrance to next in 30 min. or less. **CARVED STATUARY GROUP** *(in inset)* for one of four pediments is symbolic of fishing industry.

TO AVOID dismantling and re-erecting a derrick three times while placing a total of 320 tons of carved stone statuary in the pediments above the four 15th St. entrances of the Department of Commerce Building, in Washington, D. C., Alexander Howie, Inc., of Cleveland, Ohio, stone setting contractor, mounted an American Terry 50-ton derrick, equipped with a 130-ft. boom, on four railroad trucks which served to transport the rig between successive set-ups. A 150-hp. electric hoist, used to operate the derrick, was inclosed in a wooden shed on the steel framework and moved right along with the rig. The maximum time required to move the derrick from one pediment to another was less than 30 min.

Statuary for the four pediments was carved from a total quantity of rough stone amounting to a little more than 450 tons. This quantity was reduced by the carving operation to a total of 320 tons, or about 80 tons for each pediment. The heaviest piece of stone in each statuary group weighed about 30 tons.

A general contract for the work was let by the U. S. Treasury Department to the Consolidated Engineering Co., of Baltimore, Md. This company, in turn, let the stonework to the Indiana Limestone Corp., which entered into a subcontract with Alexander Howie, Inc., to set the stone. John E. Fraser, of New York, made the models for the statuary under the direction of York and Sawyer, architects, of New York. Half of the statuary was carved by John Donnelly, Inc., of New York, and the other half by Gino Ratti, of Washington. Information for these notes was supplied by Geo. S. Merts, engineer for Alexander Howie, Inc.

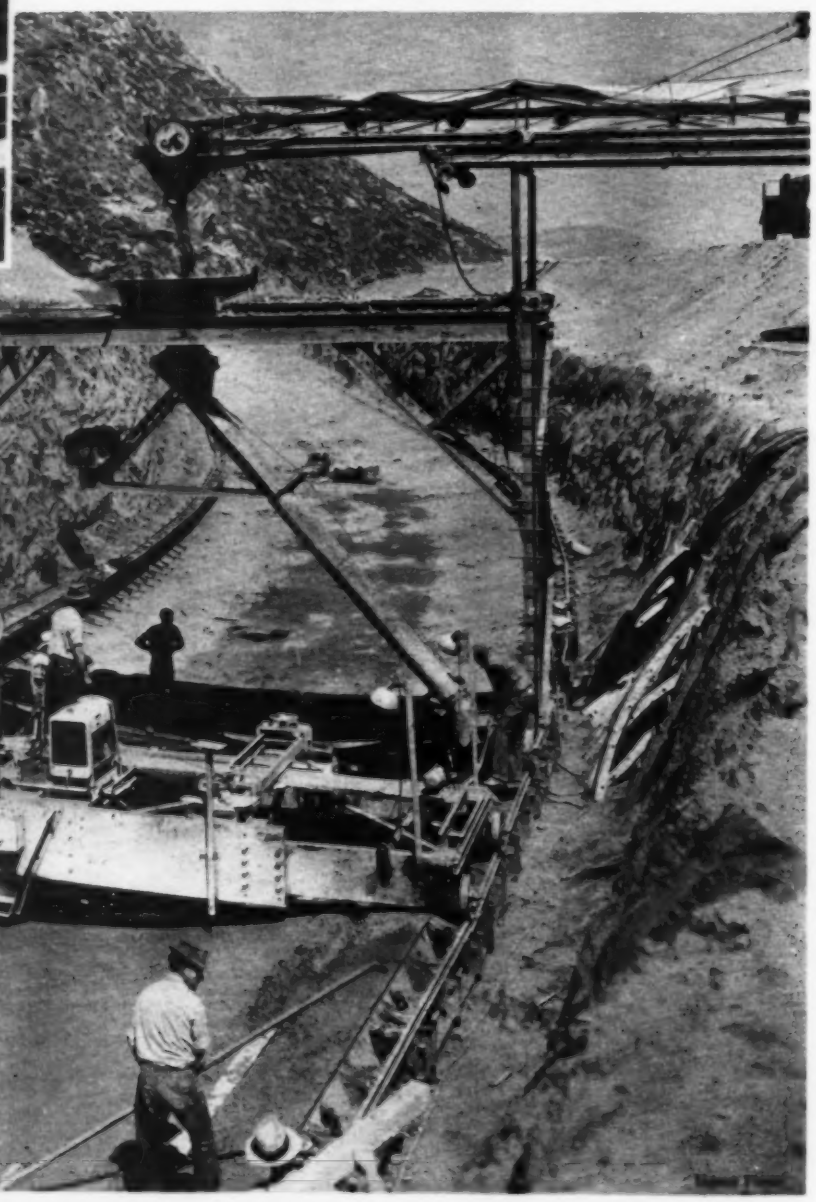
Getting Down to

DETAILS

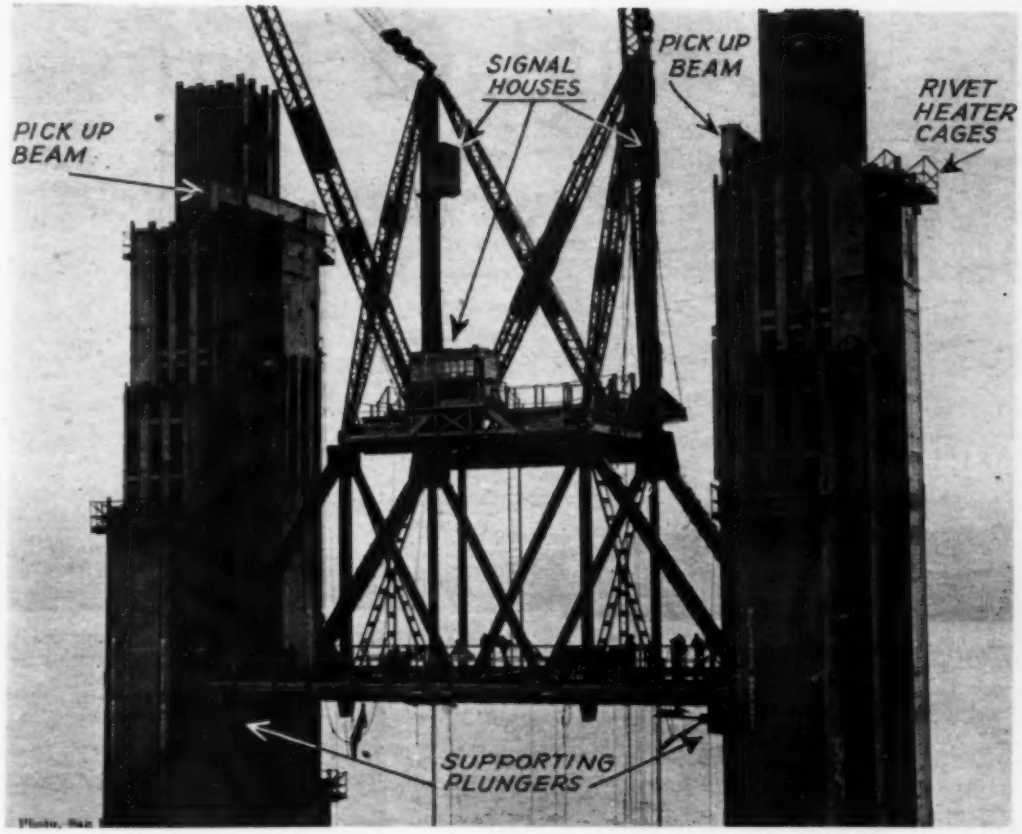
[Close-up Shots of Job Methods and Equipment]

ANTI-GLARE SODIUM VAPOR LIGHTS have been selected by Chief Engineer C. H. Purcell (standing alongside unit) as permanent equipment to illuminate roadways of San Francisco-Oakland Bay bridge in California. Approximately 1,000 light standards, 26 ft. above roadway, will be installed 150 ft. apart on both decks of bridge. Advantages claimed for lights are improved clarity of golden yellow illumination, cheapness of operation and lack of glare.

PORTABLE CONSTRUCTION BRIDGE *(below)* of light steel angles or tubing welded together to form truss supporting runway 2 ft. wide enables workmen of Six Companies Inc., at Boulder dam, to pass safely between columnar blocks of concrete forming body of dam. Cambered runway is surfaced with longitudinal planks fitted with transverse cleats to prevent slipping.



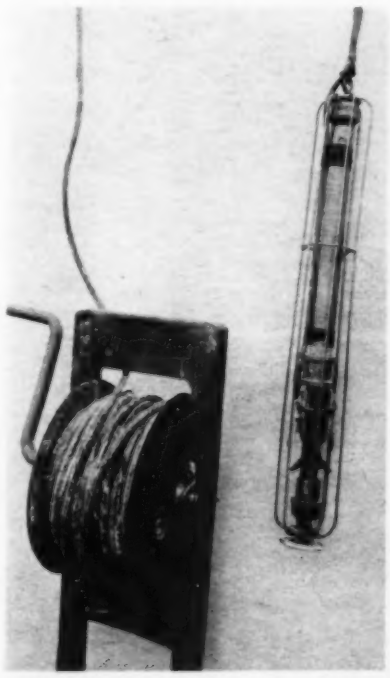
INVERT CONCRETING PLANT of Griffith Co., Los Angeles contractor, on Colorado River aqueduct rides on wheels running along track on forms. Concrete from Koehring paving mixer on bank is delivered by belt conveyor to hopper on steel gantry frame whence it descends through inclined chute with swing spout to aqueduct subgrade. Finishing is done mechanically with Lakewood unit fitted with special curved strikeoff and vibrating equipment.



CREEPER TRAVELER, weighing 260 tons and equipped with two 90-ft. booms, erects steel for south tower of Golden Gate bridge, California. Rig is raised by falls extending from four corners of traveler to beams set in tower legs above. After each lift traveler is seated on steel billets mounted below bottom chord of traveler so that they may be thrust into slots in tower. Raising is done by two 300-hp. hoisting engines. Each derrick can handle 85 tons. Traveler designed by McClintic-Marshall Corp.

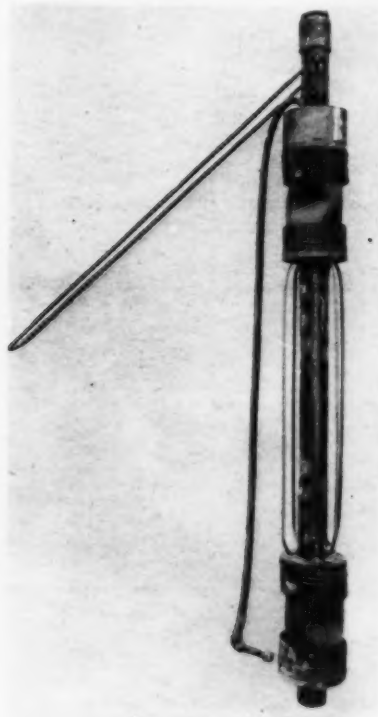
PIPE-LOWERING RIG places 14-in. Mono-cast water supply line in trench at Sweetwater, Tex. PWA project, under supervision of City Manager S. H. Bothwell, provides new 6-mi. pipe line between Lake Sweetwater and filter plant within city limits.—*Photo from American Cast Iron Pipe Co.*

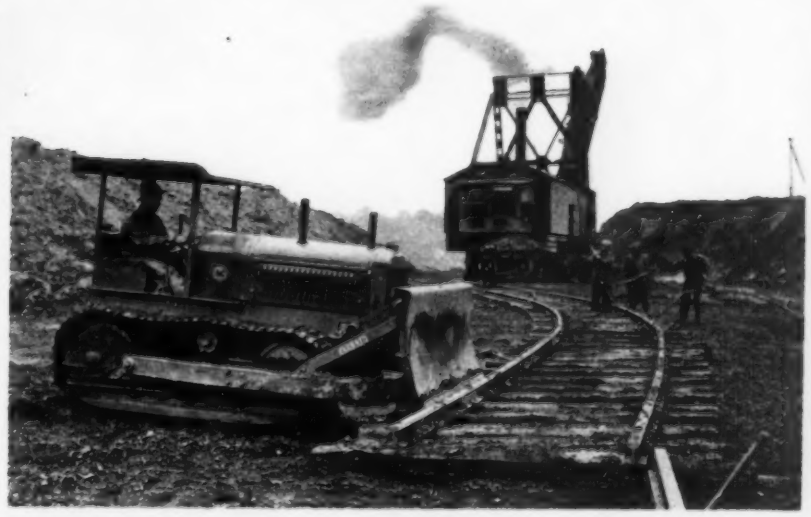
NIGHT VISIBILITY of aluminum-painted highway bridge over Green River, near Geneseo, Ill., is demonstrated by test. Illumination for safe driving is by ordinary headlights of automobile in lower right hand corner of photograph.



SUBSURFACE "FEELER," devised by Tennessee Valley Authority engineers, is lowered into deep drill holes to locate seams or faults in foundation for Norris dam. Instrument attached to end of steel cable and electric wire, taped together, is lowered into hole until plunger at end strikes bottom and releases tension on two outward flaring arms, allowing them to touch wall of drill hole. As instrument is raised slowly extended arms, still under tension, penetrate into any seam encountered and, in spreading out further, make contact which lights electric lamp in side of wire reel at surface. Lamp remains lighted as long as arms continue to flare out beyond normal diameter of drill hole. Measurement of cable paid out determines depth and thickness of seam thus discovered as preliminary to grouting.

FLUSHER, another product of TVA engineers at Norris dam, washes clay from seams located by mechanical "feeler," (illustrated at left) prior to grouting. Lowered to depth of located seam, flusher, with piping attached, is held stationary while air is forced into rubber chambers at base and top to seal off the underground fault. Then a mixture of water and compressed air is forced through perforated vents in body of flusher to clean seam of mud and clay. The flow escapes through adjacent drill holes left open as outlets. Pressure is shifted from hole to hole until seam is cleaned, as evidenced by flow of clear water from outlet holes.





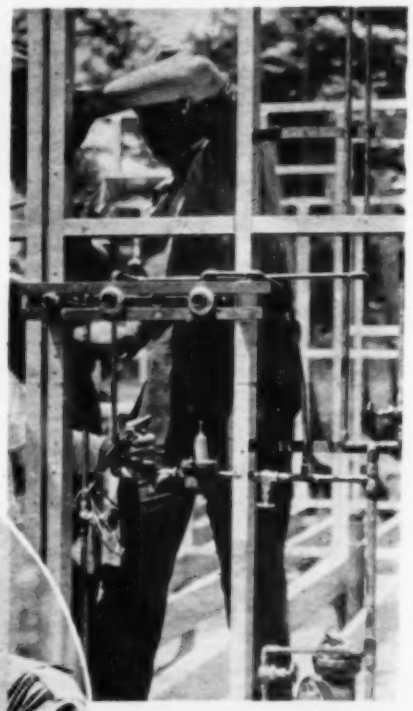
TRACK SHIFTING to serve cars loaded by big power shovel on Maumee coal mine stripping near Terre Haute, Ind., is accomplished by Euclid bulldozer on Allis-Chalmers tractor. Bulldozer also scrapes earth from coal vein in wake of shovel.

Bolted Frame of Standard Units

Permits Flexibility in House Design

TWO SIX-ROOM steel-frame houses insulated with cork and veneered with brick, recently completed at Bethesda, Md., a suburb of Washington, D. C., by Carr Bros., contractors, of that city, have been placed on the market at a price, including lots, landscaping, sewer and water connections and concrete drives, of $6,950 each. A steel frame of lightweight rectangular units shop-fabricated from standard material and bolted together in 10 hr. (actual time on the second house) improved the fire-safety, rigidity and general economy of the houses and reduced the construction period, with consequent saving in labor and interest charges. The simple framing system utilized in designing the two houses possessed a dual advantage in that it combined the economy of standard factory-produced units with desired flexibility in architectural treatment.

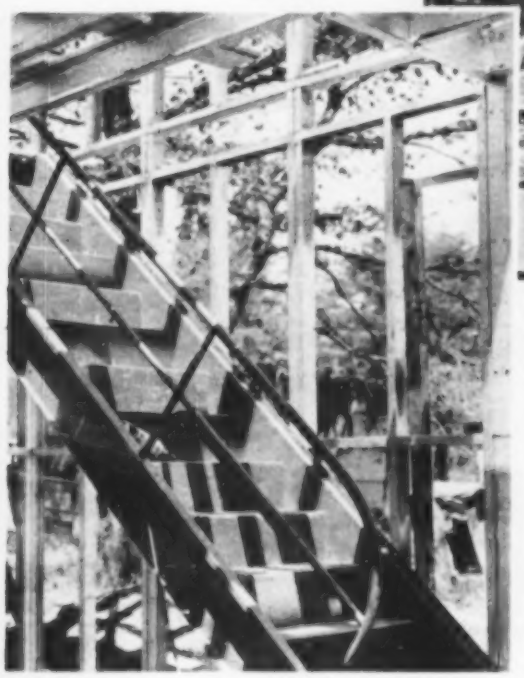
Elimination of cellars accounts in part for the low cost of the dwellings. Air ducts for a heating and air-conditioning system are built into the steel framing units. Local factors made it economical to use gas as fuel, and a compact gas-fired heating unit containing



STEEL SKELETON *(left)* **of fire-resistant, insulated dwelling utilizes shop fabricated rectangular wall frames bolted together in field.**

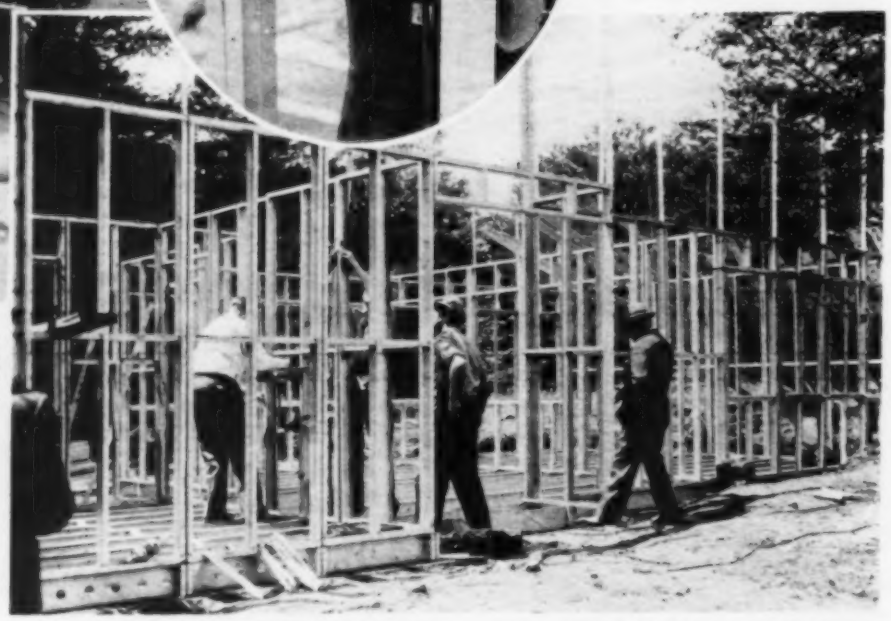
ELECTRIC WRENCH *(below)* **tightens bolts at joint between rectangular steel wall units.**

FACTORY-ASSEMBLED PLUMBING CHASE, installed as unit, eliminates labor of running pipes through walls after erection.



PREFABRICATED STEEL STAIRWAY *(left)* **leads from entrance hall to second floor.**

STEEL TEMPLET to which wall frames will be bolted is embedded in foundation concrete.



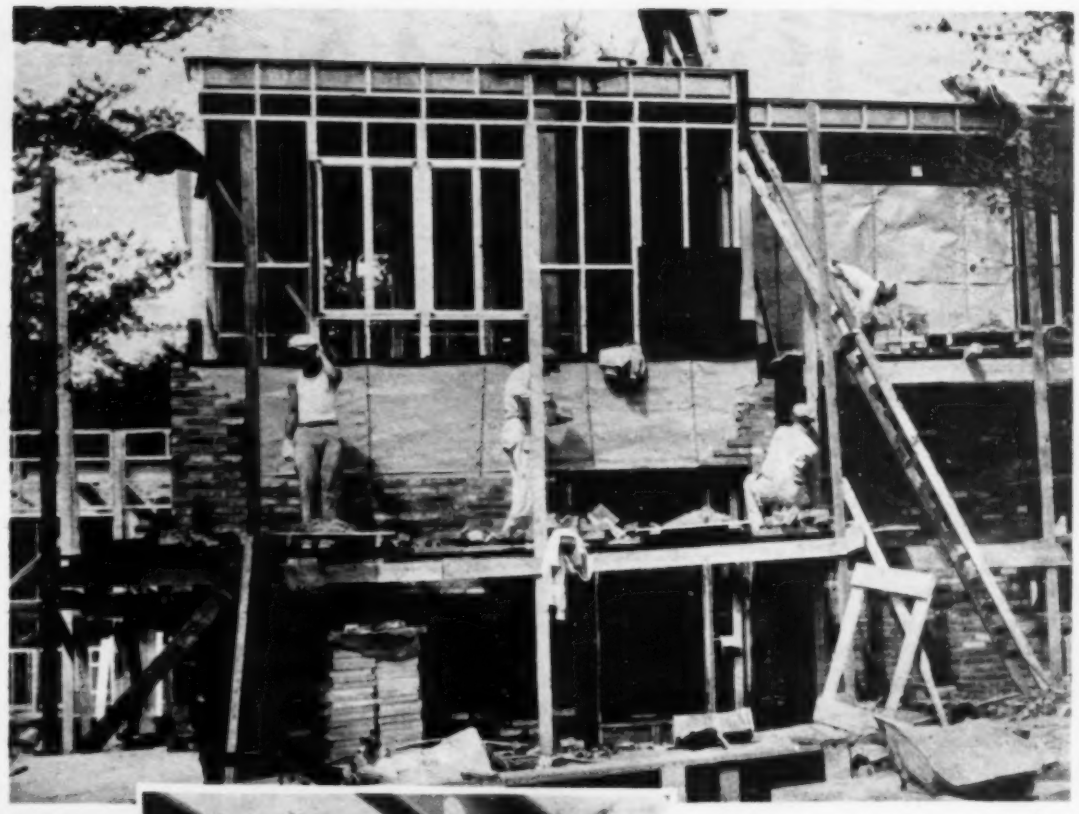
FIRST-STORY WALL FRAMES have been erected, and plumbing chase for kitchen is being installed. Reinforcing strips for joints between second-story wall frames already are in place.

filtering and humidifying equipment was installed in one corner of the kitchen. Grilled openings in the rooms discharge conditioned or heated air, and similar grilles remove used air, which passes through the floor system or through the 3-in. space in the steel frames in the insulated walls, eliminating cold floors and walls.

Steel frames for the skeletons of the two houses were fabricated from high quality strip steel to meet the requirements of the Berloy system by the Berger Manufacturing Co. (of Canton, Ohio), a subsidiary of the Republic Steel Corp. By this system, all frames are rectangular in shape, 3 ft. wide, and of desired ceiling height. Frames for solid outside walls are interchangeable with frames containing doors or windows, which are welded into the Berloy units. The rectangular steel frames are bolted to one another and to the foundation. Steel floor and roof joists are bolted to the rectangular wall units. An added economy of this type of construction is offered by prefabricated plumbing stacks (or chases) and heating and air-conditioning ducts, which are bolted in place within the frames.

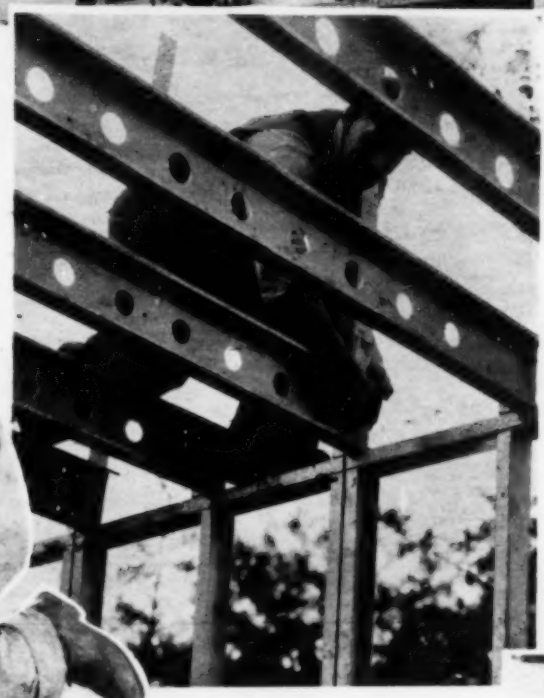
Erection is facilitated by the light weight of the framing units and floor members, which can easily be handled by one man. Insulation in the Washington houses is provided by 1½-in. corkcrete flooring on the steel floor joists, by 1-in. cork board in the exterior walls (protected by waterproofing paper), and by 1½ in. of corkcrete overlaid with 1½ in. of cork on the roofs. Any type of exterior wall facing may be applied to a Berloy steel-frame house. Carr Bros. selected brick veneer for their two properties.

Including a detached garage, the overall dimensions of each of the steel-frame dwellings is 49 ft. 5 in. by 31 ft. 2 in. The house alone contains 1,372 sq.ft. of floor area, in addition to 120 sq.ft. of covered porch and the single-car garage. All waste space was eliminated from the designs, which utilized every modern device and improvement for restful, healthful living.



BRICK VENEER *(above, right)* is laid up against waterproofing paper covering layer of cork insulation. Steel frame permits use of any type of wall facing.

CORK INSULATION applied to wall framing is tied by wire to steel studs.



CORKCRETE SUBFLOORING *(below)* laid on steel joists is fastened down by wire ties run through locking plates in corkcrete slabs.

STEEL JOISTS of second floor are bolted to first story wall frames.

10 HR. AFTER START OF ERECTION, steel frame of six-room house and detached garage is completed, including steel stairs, heating and ventilating unit, and plumbing connections.

TIEWIRES placed in mortar between brick courses bind brick veneer to steel frame. Wires are twisted around vertical steel rods which hold waterproof paper and cork insulation to steel frame.

JOB MANAGEMENT
IN ROAD BUILDING

Fifth of Six Articles Dealing With Factors That Affect Equipment Selection, Operation and Dependability, Production and Cost

–5–

Concrete Pavement Construction

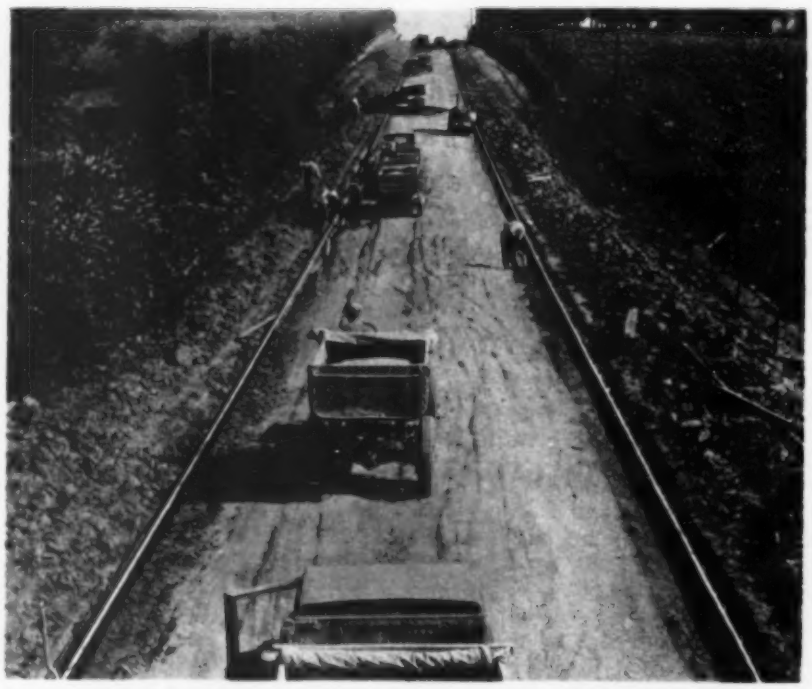
By J. L. HARRISON

Senior Highway Engineer, U. S. Bureau of Public Roads, Washington, D. C.

IN THE PRECEDING chapter, published in last month's issue, the management of power shovel grading operations was discussed as primarily a matter of the proper tooling of the successive operations grading involves. On a thoroughly modern grading operation all of the successive processes are mechanized. Outstandingly, then, the management of grading work is the management of machines, for often about the only labor to be found on such a job is that required in the operation of these machines.

Laying a concrete pavement can now be almost as completely mechanized as the thoroughly modern grading operation is, but in order to bring out certain points which are of importance from the management standpoint it will be treated on the more usual basis, that is, on the assumption that certain processes are handled on a hand-labor basis.

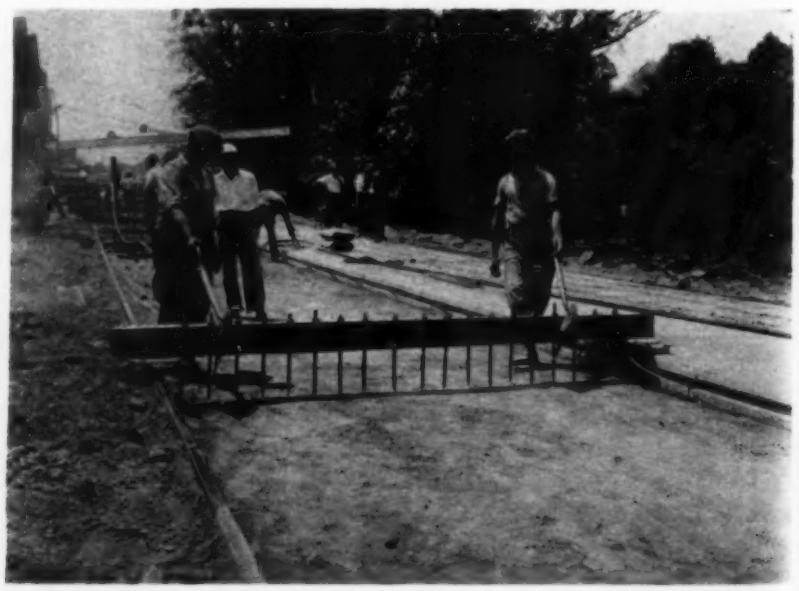
As in the case of grading, the dominant aspect of concrete pavement construction is the series of successive interdependent operations by which raw materials are converted into a finished product. In principle this series differs not a bit from any other production series, for wherever production depends on a series of interdependent operations this fundamental consideration in management always dominates: Job production cannot exceed the productive capacity of the least productive process. As compared with the grading series, however, the concrete paving series stands out as longer and, therefore, more difficult to manage successfully. Moreover, concrete paving involves not one but two separate and distinct series of operations which, while not rigidly interdependent, are so related that the two must be closely coordinated. These are (1) the fine grading and form-setting series and (2) the paving series. There is here, then, a good deal more complexity than is found in the management of grading, but no difference in principle.



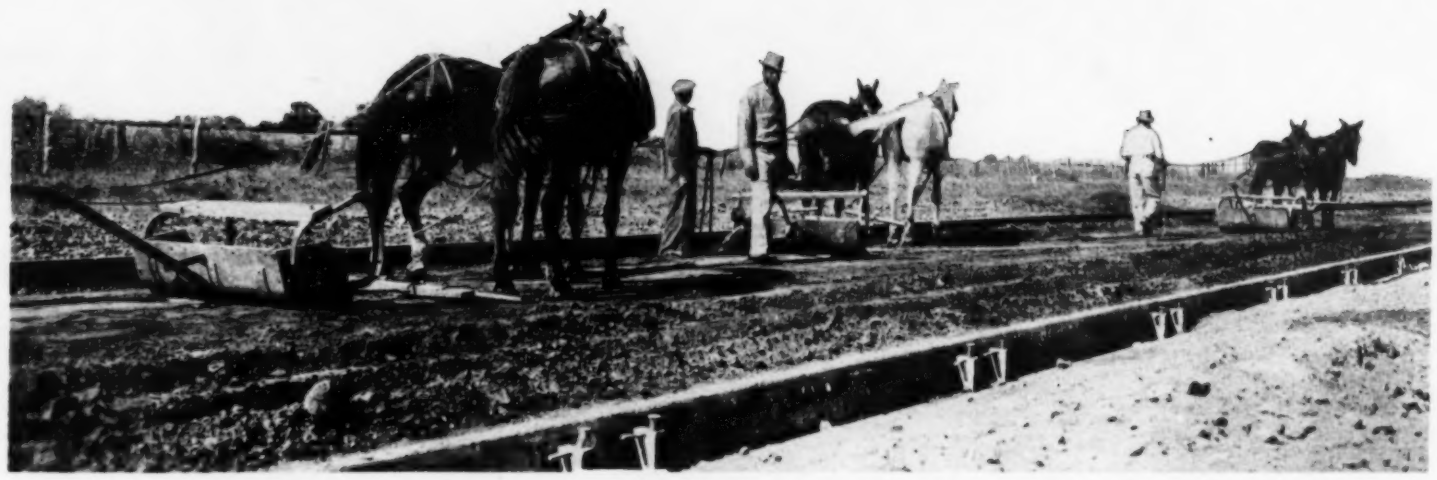
LOOKING AHEAD from the paving mixer. There is some excess of hauling equipment here, but a moderate excess is to be preferred to a deficiency — costs less.

Fine Grading and Form-Setting — Fine grading and form-setting are, quite generally, handled on the basis of the following series of operations:

1. Roughing out the grade—done by fresnos, blade grader or some similar tool or by hand labor.
2. Setting forms—hand labor.
3. First fine grading—subgraders and hand labor.



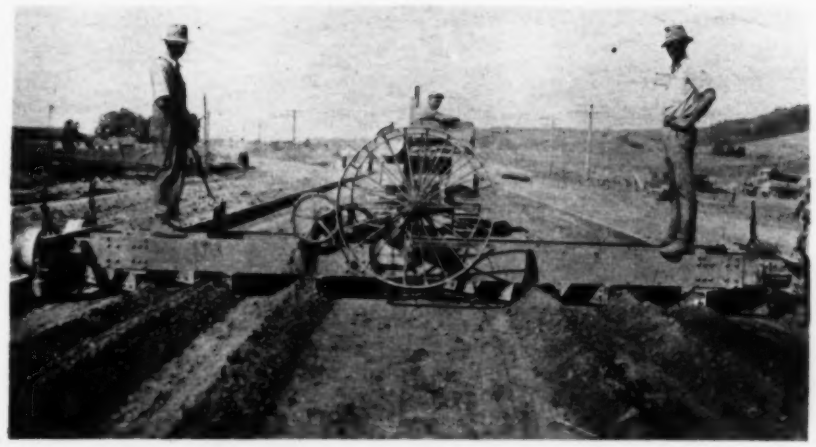
MODERN EQUIPMENT on the subgrade. After tractor-hauled blade grader *(left)* has brought earth base approximately to proper profile between forms, fine grading is completed and checked for accuracy of surface *(right)* with toothed all-metal subgrade tester supported at ends by road forms.



4. Rolling—power rollers.
5. Final fine grading — subgrader and subgrade planer, with hand labor.

The series of operations above noted is largely a matter of hand-labor, though some fairly heavy equipment is used in connection with it.

There is no very exact tie-up between this series and the paving series, for neither series is rigidly dependent on the other. On the other hand, for many practical reasons, the subgrade cannot be completed very far in advance of the paving and obviously no paving can be laid until the subgrade for it has been prepared. In practice, therefore, the two series must be, and are, kept about in balance, though the fact that pavement can be laid as long as there is any fully prepared subgrade on which to place it and that subgrading can be continued until it is from 1,000 to 2,000 ft. in advance of the pavement creates here what is, in effect, a modest amount of storage between related processes.



MECHANICAL EQUIPMENT *(above)* has been developed for finishing earth subgrade instead of hand labor and horse-drawn fresno scrapers *(top of page)*.

"Mechanical dependability all along the line is desirable and any machines which definitely lack dependability should be completely overhauled or replaced if lost time for the job as a whole is to be avoided."

This storage serves measurably to reduce the rigidity of interdependability one finds, for instance, between a power shovel and the trucks that serve it, there being in this latter case absolute dependability of the first process on the second—a condition in which no work can be done by the first unit unless the second is on hand to receive it. The fact that the supply of finished subgrade ahead of the mixer can be varied, if indeed between rather restricted limits, is, then, of real service to the management, for it introduces an element of valuable flexibility where it is most convenient to have it.

To state this matter a little differently, the average rate at which the subgrading and form-setting series of operations is conducted must be the same as the average rate at which the paving series of operations is maintained, but as long as fluctuations in the rate at which either series is handled neither creates an excessive amount of finished subgrade nor entirely wipes out the finished subgrade, the rates at which the two series are temporarily operating may vary a good deal without affecting job production.

Paving Operations—The second series, the paving series, involves:

1. Batching and loading the aggregates —a crane and batching bin.
2. Loading the cement—a cement loader or hand labor.
3. Hauling—trucks.
4. Mixing—the paver.
5. Puddling—hand labor.
6. Finishing — the finishing machine followed by hand labor on finishing.
7. Covering and curing—hand labor.

Stated in this way it is apparent that the job management must deal with two related, though somewhat independent, series of operations which must be designed for equal average rates of production. This, as in other cases, means that the first matter for the job management to consider is the selection of a rate of output these two series will be designed to sustain. On a concrete paving job the paver is the key producer. The remainder of the construction organization is built around it.

The selection of a rate of operation for the job as a whole must, then, begin with a consideration of the capacity of the mixer. Here the first consideration is specification requirements and their enforcement. As the concrete must be properly mixed, specifications generally define the minimum period during which materials must be held in the drum. It takes some time to get these materials into the drum and to get them out again. If the required time in the drum is 60 sec. the overall cycle is not likely to be much under 75 sec. Often such matters as the usual interpretation of specifications or the condition of the mixer—occasionally even the condition of the materials which are being used—will further add to the cycle.

"A crane that is in poor condition or that is too small readily to handle the work there is to do is a liability no job can afford. A first-class operator for it also is an essential to sustained production at the scheduled rate."

KEY PRODUCER on concrete paving is the mixer. Production schedules for entire job are geared to its performance.

If the average mixing cycle is 75 sec. the production of 48 batches an hour is theoretically possible. If the average mixing cycle is 80 sec., the production of 45 batches an hour is theoretically possible. Longer cycles correspondingly reduce the possible rate of production.

Rate of Output—The rate of output it is theoretically possible to obtain at the mixer cannot always be taken as the rate the construction organization should be designed to sustain, for if this rate is to be sustained the mixer operator must be a man who has considerable physical stamina and who is steady and dependable as well as highly skilled. Such men are not always readily available nor can every operator be

Smoo-Ther

EXTRA YARDAGE AT LOWER COST

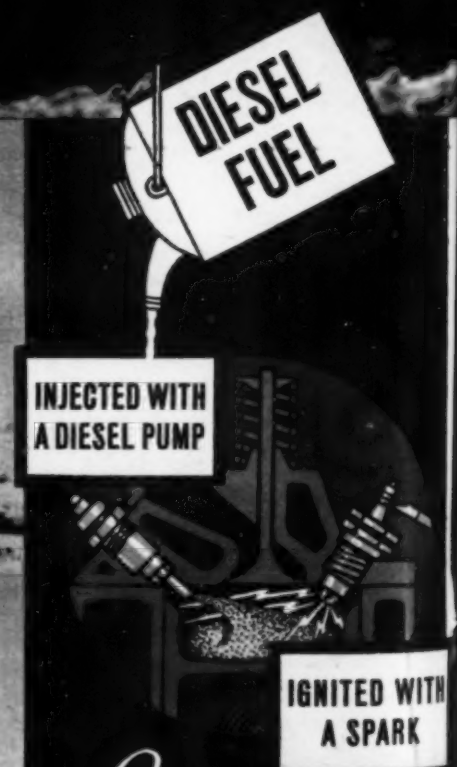
"L-O" LOWERS DIRT MOVING COSTS ON MICHIGAN HIGHWAY—MORE DIRT PER TRIP—MORE TRIPS PER HOUR THAN ANY OTHER TRACTOR

Responsive

This Model "L-O" Oil Tractor steps out faster on the Schwaderer job—"Where you want it, when you want it".

20,000-Pound Scraper

The "L-O" demonstrates its power by filling the scraper bowl with more dirt than competitive tractors.



Gives you:

EASIER STARTING
SMOOTHER OPERATION
LESS VIBRATION
FEWER REPAIRS

OPERATION...

THE vital advantage of low compression in a Diesel-fuel burning tractor is demonstrated on the E. B. Schwaderer job near Detroit. In competition with other makes, the Allis-Chalmers Model "L-O" handled a big 20,000-pound scraper to better advantage ... "got there" quicker ... filled the scraper bowl with more dirt ... delivered about three loads more per hour on the same average haul.

Why? Because of *smoother operation.* Allis-Chalmers Oil Tractors employ a new, improved system of engine operation which eliminates the need for high compression pressures. Diesel fuel is injected into the combustion chamber with a Diesel pump and ignited with a spark. High compressions are not necessary for ignition—compression pressures are only one-fourth to one-third those of the unimproved type.

Result—The Allis-Chalmers Oil Engine is not compelled to labor against high compression pressures. Operation is smoother. Less strain on working parts. Less vibration and wear. Fewer repairs. Claims can't compare with *facts* ... A-C Oil Tractors do the work at Lowest Final Cost.

ALLIS-CHALMERS
TRACTOR DIVISION—MILWAUKEE, U. S. A.

A-C OIL TRACTORS
FOR LOWEST FINAL COST

trained to maintain a high rate of output at the mixer. Accordingly, it often is good policy to plan on a little less than the theoretical rate obtainable at the mixer, for if the whole construction organization is designed to sustain a high rate of output and this rate of output cannot be sustained at the mixer, the whole organization must consistently work at less than full capacity. The unnecessary expense a condition of this sort involves is considerable.

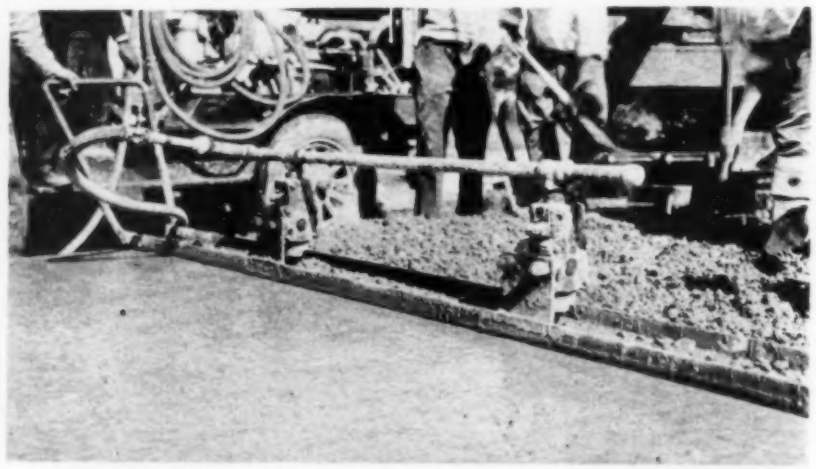
The decision as to the rate of output to be used, no matter what this rate is, creates the basis for the design of the construction organization. Each process in each of the two series work of this sort involves must then be considered separately and individually and so tooled or manned that it is capable of supporting the rate that is to govern production for the job taken as a whole.

AT MATERIALS YARD note small amount of crushed stone and sand in storage. This is good practice provided that truck delivery is dependable, as it saves rehandling costs.

them to it and the mixer simply cannot mix them until they are delivered and loaded aboard. The proper tooling of the hauling operation is, therefore, an absolute essential if any planned rate of production is to be supported.

Inevitably the distance materials must be moved varies from day to day and from hour to hour and so the number of hauling units it is necessary to operate will also vary. Still, with a known distance from the materials yard to the mixer, a known, or a readily determinable, proper travel speed, a readily determinable period required for taking on a load and for discharging it at the mixer, it is a very simple matter to calculate the round-trip time required to handle a load and from this to determine the number of trucks that are required to support a specific rate of production at the mixer. If the trucks are

IN THE WAKE OF THE MIXER. Plenty of mechanical equipment for finishing the concrete pavement, but not many men.



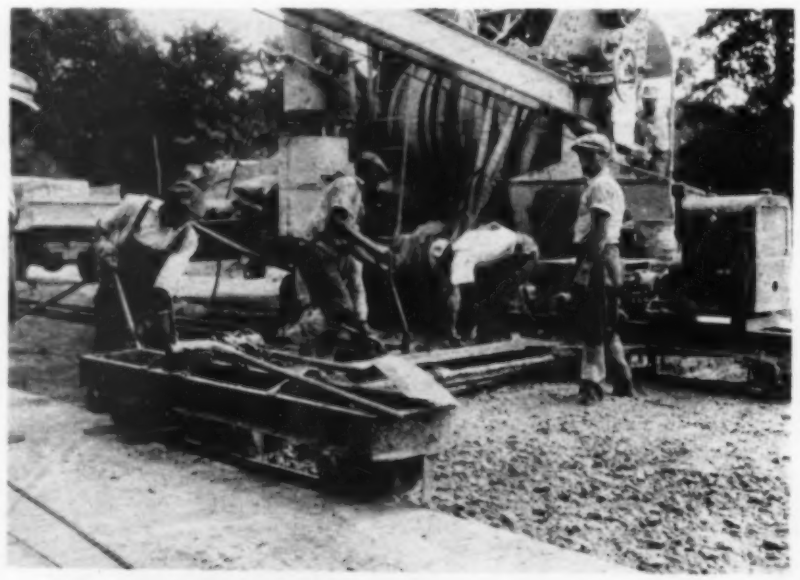
MECHANICAL VIBRATION of concrete is one of the newer finishing processes to produce a pavement of superior quality.

Dependability of Equipment — On the mechanical side, the proper tooling of the job involves, as a matter of first principle, the use of dependable equipment. This is particularly a factor of importance in the selection of the paver. The paver is the key producer and inevitably any time lost here becomes a subtraction from the working time which causes a corresponding loss of production. As a rule there is little or no possibility of corresponding adjustment in construction cost, with the inevitable result that any lack of dependability at the mixer reduces the production per work-dollar expended.

On all other mechanized operations the dependability of the machines placed on the job also is important but, as a rule, not quite as much so because most of these have a rated output capacity which exceeds the selected job production rate. For this reason most other machines can make up the occasional loss of a little time without interfering with job production. Nevertheless, mechanical dependability all along the line is desirable and any machine which definitely lacks dependability should be completely overhauled or replaced if lost time for the job as a whole is to be avoided.

Of the mechanical equipment other than the paver, the crane in particular should be a thoroughly dependable unit and should have some excess capacity. A crane that is in poor condition or that is too small readily to handle the work there is to do is a liability no job can afford. A first-class operator for it also is an essential to sustained production at the scheduled rate.

Hauling — Probably the most common cause of low production on paving jobs is the undertooling of the hauling operation. If the paver is to mix 45 batches of concrete per hour, or 40 or any other scheduled number, that number of batches must be delivered to it. This is a fact that cannot be escaped or avoided. There is no way of getting batches to a mixer except by hauling



STRIKEOFF MACHINE, following behind mixer, brings concrete surface to proper level for application of steel reinforcing mats before top course is poured.

available it is good practice to send out enough of them so that the computed hauling capacity of the trucks exceeds the planned rate of production at the mixer by about 10 per cent. The trucks should be available as a matter of managerial policy, except for hauls of unusual length which are to be encountered only on rare occasions.

Hand Labor—The proper tooling of all mechanized operations having been attained, there still remains the matter of properly manning hand-labor operations. It is just as essential that these have the right output capacity as that the mechanized operations have the right output capacity. In short, each of these should be manned to meet the rate of production which has been selected for the job taken as a whole. This must be done quite accurately or cost will be increased. If some of these processes are undermanned, inevitably production suffers with the result that the production per work-dollar spent is reduced through losses on the production side of the work. If too many men are employed, production is maintained but cost is increased. When this occurs the production per work-dollar expended is reduced on account of increases in the cost side of the work. Both situations are to be avoided, but it takes a good deal of skill on the part of the superin-

LONG-HANDLED FLOATS *(left)* and longitudinal screed *(right)* operated from wooden bridges, are among tools used to give finishing touches to concrete surface and improve its smooth-riding qualities.

tendent and the foremen to avoid them and no little real knowledge of the amount of work men can do day after day.

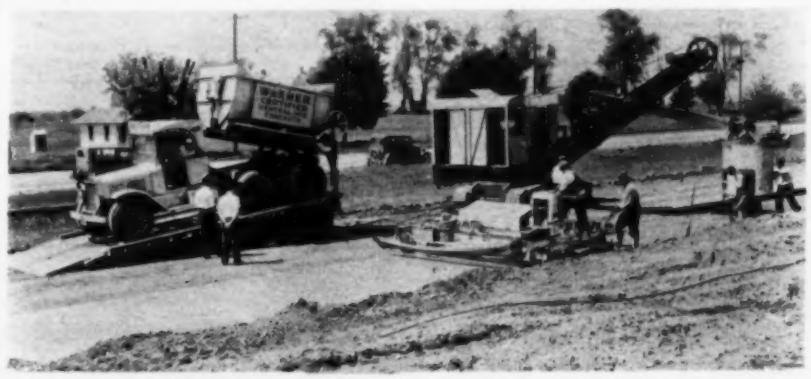
In manning hand-labor operations it has been the observation of the writer that there is a marked tendency to provide a considerable excess output capacity. When subsidiary operations are tooled, this usually is done but here it is not, as a rule, expensive to do, for as between machines which may be available, the difference in overall operating cost for a machine that is just large enough to do the work and one that has a 25-per cent over-capacity is small. But when a hand-labor operation is manned to an output capacity 25 per cent above the selected job production rate, the cost of maintaining it has been increased 25 per cent. It is much better practice to man it for the established rate and then, if necessary, to give it close supervision and, in addition, to give the laborers careful training in the manner their work should be done.

"The average rate at which the subgrading and form-setting series of operations is conducted must be the same as the average rate at which the paving series of operations is maintained."

Training Workers—Too little attention is given to this matter of training laborers to work efficiently. On fully mechanized operations the men who handle the machines are presumed to have attained skill through long experience with the machines on which they work. Even these men will often do better if they are given special instruction in the details of machine operation. However, the reference here is to the training of unskilled laborers. As simple a matter as moving earth with a hand shovel will be better done and more easily done if the laborers are shown exactly how to do it. A surprisingly large percentage of the laborers employed on construction work have no real knowledge of how best to use the hand tools with which their work is performed. Maintaining production in hand-labor operations with the right number of men requires that attention be given to just such details as this. Parenthetically, it may be remarked that not a great many foremen and, indeed, not too many superintendents, are well versed in these details or in their importance in the management of hand-labor operations.

TRUCK MIXERS, instead of pavers traveling on or alongside subgrade, are among the newer developments for large-scale concrete paving projects.

In managing hand-labor operations, particularly on a paving job, the amount of work the laborers have to do can often be favorably affected by the careful performance of an interdependent mechanized operation. This matter can, perhaps, be clarified by a simple illustration: Usually 4 puddlers are used to spread the concrete back of the mixer, and if the mixer operator dumps the concrete in one pile, these men are worked to capacity. However, if the mixer operator spreads the concrete as he drops it, the amount of work to be done is considerably reduced. On only one job has the writer ever seen the number of puddlers reduced to two. This was a job on which production was maintained at a very high rate, an average for the season of between 44 and 45 batches an hour, but the two puddlers had no difficulty in handling their work and doing it correctly. The reason for this lay in the fact that the mixer operator had been trained (trained is exactly the right word, for his efficiency was the result of thorough training by the superintendent) so effectively to spread the concrete as he emptied the bucket that the puddlers had little work to do on it. There are several places on a paving job and many places on other types of work, where the number of men required on hand-labor operations can be reduced by training the operators handling interrelated mechanized operations to do their work more accurately.



UNIQUE PLANT for laying pavement consists of truck mixers dumping into bottom-dump bucket on boom of converted power shovel.

A properly balanced productive capacity throughout the construction organization having been developed, production should proceed smoothly and according to schedule. This does not mean that no further difficulties will be encountered. Inevitably they will be. It does mean, however, that their solution is not rendered more difficult by reason of inadequacies in the organization itself. This can be kept on schedule or, at the worst, nearly on schedule, if it is a fundamentally sound organization. If it is not fundamentally sound, there is no hope of keeping it on schedule.

"A surprisingly large percentage of the laborers employed on construction work have no real knowledge of how best to use the hand tools with which their work is performed."

Other details of the job management of concrete paving do not differ in principle from the details of job management on other types of work. They will not, for that reason, be further discussed in this connection. Reference might, perhaps, be made to some phases of the handling of materials which are important in the successful management of paving operations. These, however, do not differ much from the problems faced in handling asphalt pavement so their discussion is reserved for inclusion in the next and concluding article in this series.

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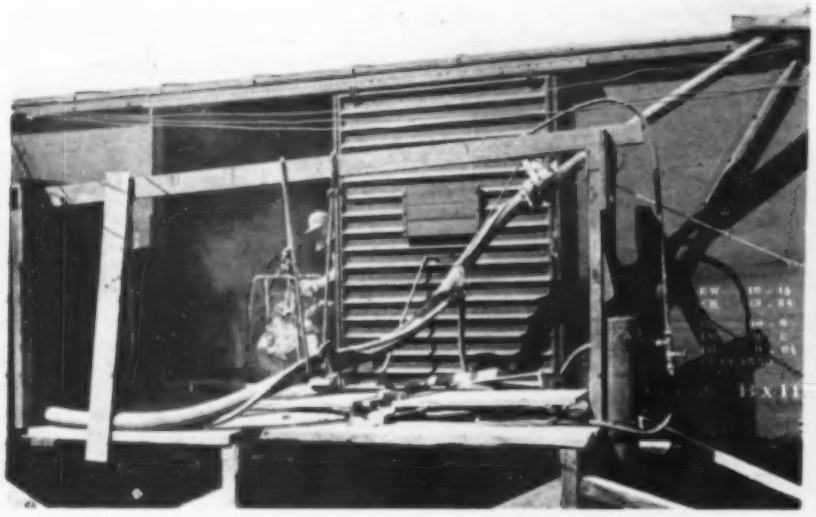
NEXT MONTH—Concluding this series on Job Management, Mr. Harrison will discuss in the August issue, "Bituminous Paving Operations."



BULK CEMENT is unloaded from box cars by manually controlled portable pumping unit and is conveyed through rubber tube and steel pipe to batching plant.

BATCHING PLANT is controlled by separate switches from central switchboard for weighing sand, coarse aggregate and cement. Dry batches discharge from hopper under 450-bbl. cement bin into side-dump cars for delivery to mixing plant.

LIGHTWEIGHT AGGREGATE

on San Francisco-

TO REDUCE dead load on the structure, the upper deck of the San Francisco - Oakland Bay bridge, 58 ft. wide, for exclusive use of passenger vehicles, is being paved with concrete which weighs only two-thirds as much as ordinary concrete but which the engineers claim has the same strength, durability and workability as standard concrete. Weighing only 100 lb. per cubic foot as compared with the usual 150 lb., the product has met all tests prescribed by the bridge authorities. Any additional cost involved in using it is offset by a total saving of more than 20,000 tons in the upper deck dead load which the bridge structure must support. The upper deck of the east and west bay crossings of the bridge, a total distance of 4½ mi., is being paved with this lightweight concrete by the Bates & Rogers Construction Co., of Chicago.

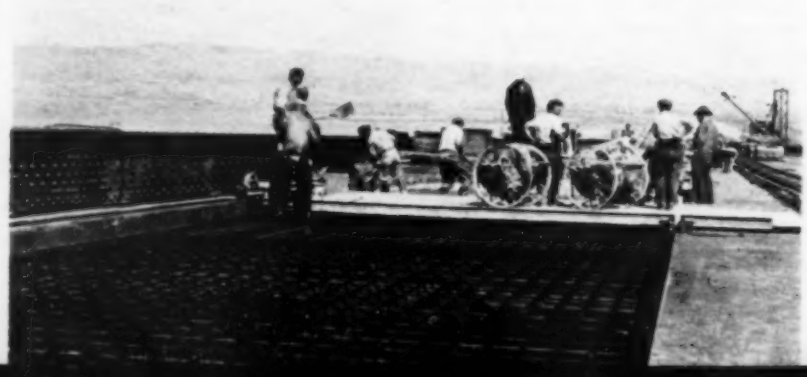
Lightweight aggregate for the concrete, called Gravelite, is manufactured from a mixture of hard shale and soft clay mined in a quarry not far from the bridge. After burning at high temperature for an hour in a rotating kiln, the mixture has a light, frothy quality. Concrete made with this aggregate retains desirable strength and at the same time provides three times the heat insulating

MIXING PLANT *(left)*, set up at east end of main bridge structure, receives 1-cu.yd. batches from side-dump cars. After 2 min. mixing, tilting mixer discharges batch into bucket in tower (at left) which raises concrete to upper deck.

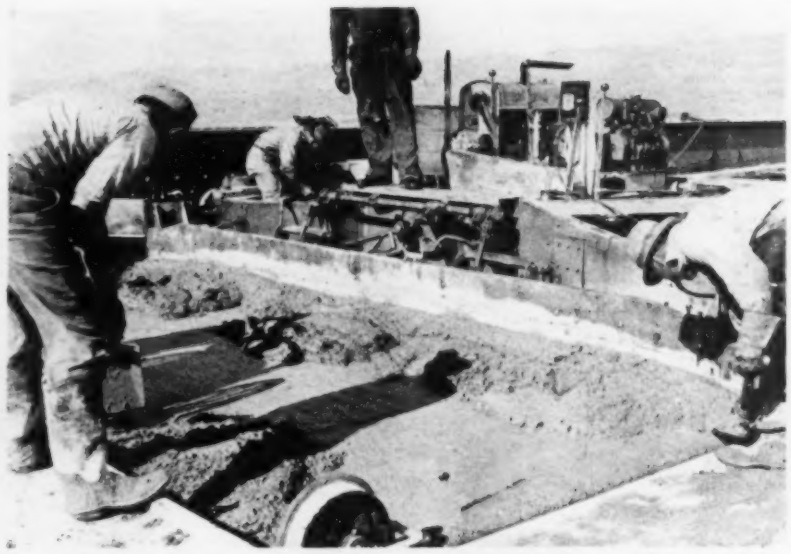
UPPER DECK OF BAY BRIDGE between San Francisco and Oakland is paved with lightweight concrete incorporating special hard-burned aggregate made of shale and clay. White tile markers set

AT UPPER LEVEL, bucket discharges into 4-yd. hopper which feeds concrete into special two-compartment cars, drawn in trains of four by 7½-ton gasoline locomotives.

ROLLING PLATFORM BRIDGE *(below)*, spanning steel reinforcement, carries hand carts which distribute concrete from railway cars to deck forms.



VIBRATION of 5¾-in. base course is obtained by means of three electric vibrators mounted on front screed of finishing machine, aided in vicinity of floor beams and expansion joints by manually operated mechanical vibrator.



AFTER PLACING ABOUT 40 FT. OF BASE, paving crew spreads ¼-in. top dressing of ordinary sand-cement concrete, giving slab total thickness of 6 in.

REDUCES PAVEMENT LOAD

Oakland Bay Bridge

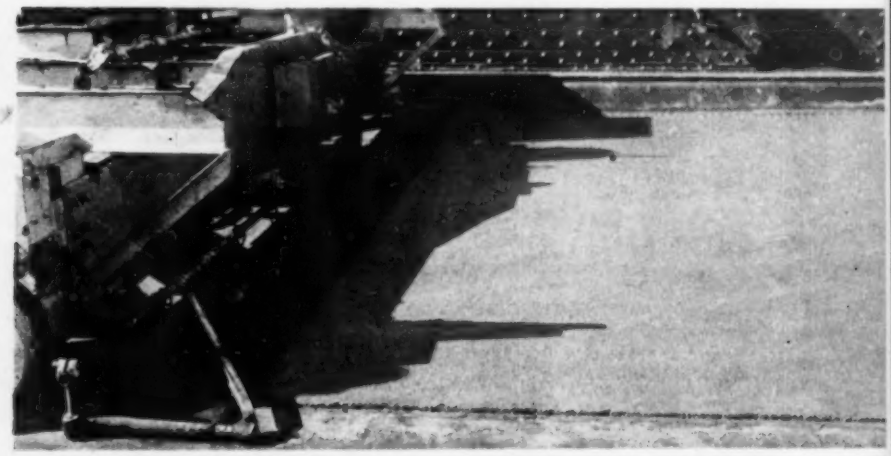
in surface of reinforced slab separate five traffic lanes of 54-ft. roadway. Concrete is delivered by railway and is spread across 20-ft. paving strip by buggies on rolling platform.

value and almost twice the elasticity of concrete made with crushed rock. Despite these properties it still meets the compression requirement of 3,000 lb. per square inch in 28 days.

Batching and Mixing Plant—A crew of five men operate the batching plant. In it six automatic electrically controlled Johnson weighing hoppers of 1-yd. capacity deliver to a belt conveyor feeding a hopper which discharges into cars in a delivery train. Above the loading hopper is an automatic weighing device through which cement is added. From the batching plant gasoline locomotives haul trains of four dump cars containing dry batches for the mixer.

At the mixing plant, the batches pass through a 1-cu.yd. Smith tilting mixer in which the mixing period is 2 min. Four men operate equipment delivering mixed batches in a tower skip to the upper bridge deck where the skip automatically dumps into a 4-cu.yd. loading hopper. This hopper delivers to dump cars that take the concrete to the roadway.

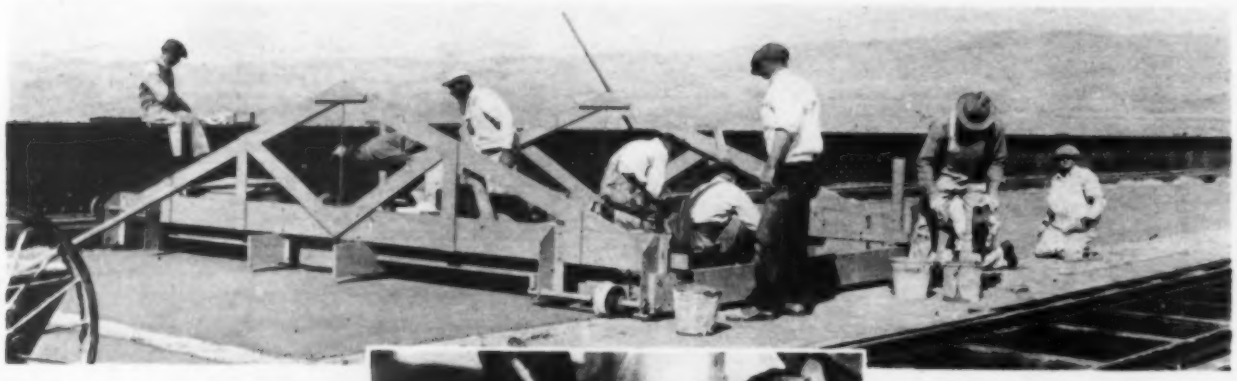
Paving Operations—The finishing



ON LAST TRIP OF FINISHER, belt at rear of machine belts surface of concrete transversely.

LONGITUDINAL BROOMING *(below)* gives finished concrete coarse-grained surface to aid tire traction.

BOTH FINISHING - MACHINE SCREEDS *(below)* are operated in striking off top course of pavement.



TRAVELING TIMBER BRIDGE *(left)* carries workmen and tools needed in installing white tile traffic markers.

THROUGH OPENINGS IN TEMPLET at one edge of traffic-marker bridge, workman scoops out concrete with special tool which prevents digging too deeply.

WHITE TILE (several of which can be seen at left of templet) are driven through openings with wooden follower designed with shoulders to prevent over-driving.

AFTER REMOVING TEMPLET, workmen finish concrete surface around tile.

machine, a Jaeger-Lakewood, has three vibrators mounted on the first of two power-driven screeds. Concrete is vibrated once and screeded once, with the forward screed set ¼ in. below finished grade. Because screed vibration is less effective over floor beams and adjacent to expansion headers, a manually operated mechanical vibrator is used at these points.

After about 40 ft. of base course has been screeded, the finisher moves back to its starting point, and a topping of sand and cement (1:3 mix) is placed and screeded twice, using both screeds. A belt attached to the rear of the finishing machine belts the surface transversely during the last screeding operation. With the finishing machine are two men spreading concrete, two wheeling it in in buggies, one operator on the machine and three other men, a total of eight for the operation.

Tile Traffic Markers — Behind the finishing machine is a bridge used by two finishers with floats who smooth up the surface with transverse strokes. Then follows another bridge spanning the freshly placed concrete to serve the traffic marker crew and to carry within convenient reach a supply of white vitrified tile. These tile are forced down into the fresh concrete until their upper faces are flush with the finished roadway surface, forming a durable traffic stripe. The tile selected for this purpose are a special product, 4 in. square and ⅝ in. thick, made of a pure white material

TOP-COURSE CONCRETE around tile is tooled and finished to leave white markers cleanly exposed and flush with surface.

EMULSIFIED ASPHALT sprayed on surface seals moisture in concrete for curing period.

which has an extremely low absorptive capacity. These tile are believed to be highly economical substitute for a painted traffic stripe which would require replacement every six months.

A templet on one edge of the traffic-marker bridge automatically locates the tile as to position and spacing. A workman removes a small quantity of topping from each templet opening to make space for the tile. Into each opening a tile is dropped and pounded down into the concrete with a wooden follower and hammer. The follower has a shoulder which engages the templet when the tile is at the proper depth in the concrete, thus preventing the workman from over-driving it.

Another light wooden bridge spanning the fresh concrete is used in connection with two final operations, namely (1) a light longitudinal wiping with a brush of coarse bristles to give the surface a slight graining parallel to traffic movement and (2) the final operation of applying a Hunt process seal coat to the freshly finished concrete surface.

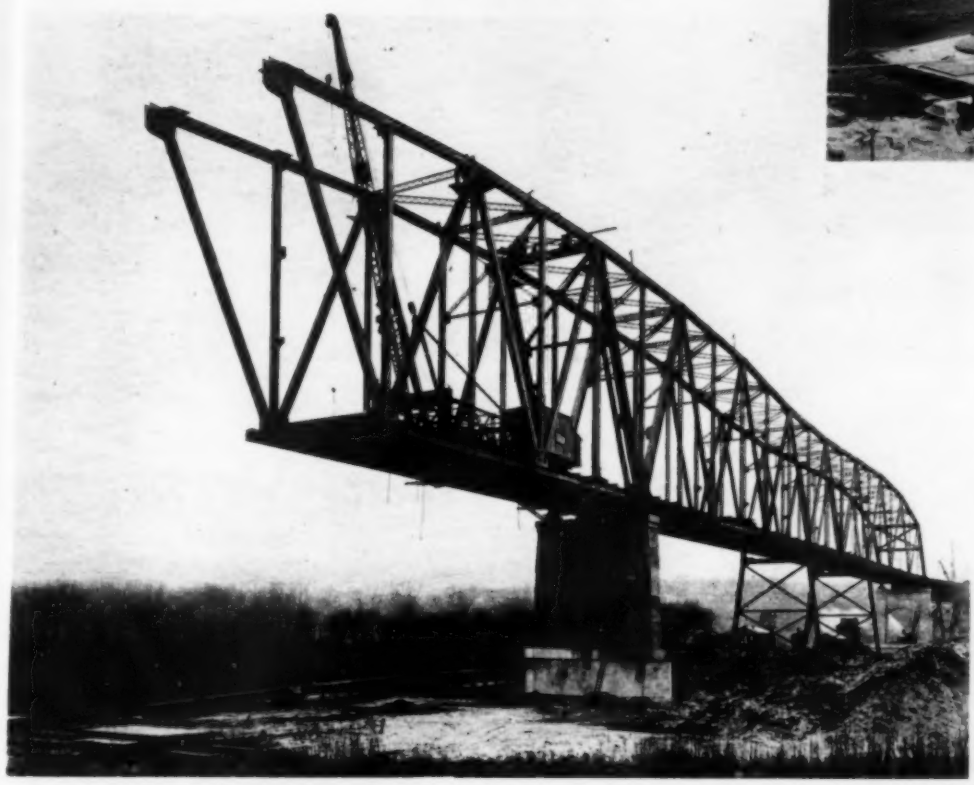
Reinforcing in the paving is largely ½-in. longitudinal rods which are brought to the job made up in welded trusses 30 ft. long. These trusses are welded to the floor beams. Forms between the floor beams consist of ⅝-in. plywood panels used repeatedly as the work progresses.

With the equipment and crew described, concreting progress for pavement slab 6 in. thick and 20 ft. wide is about 50 lin.ft. per hour.

JOB ODDITIES

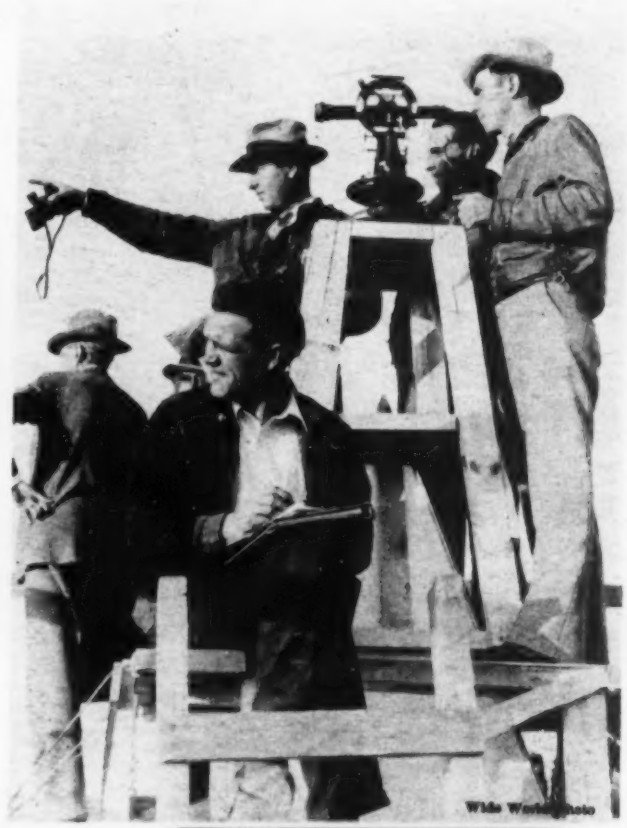
A Monthly Page of
Unusual Features of Construction

AIRPLANE PROPELLER driven by Liberty motor operates flat-bottomed boat with draft of only 4-in. (for negotiating shallow rapids), used for photographic survey work on Colorado River at Boulder dam. Behind camera is B. D. Glaha, official photographer for U. S. Bureau of Reclamation, who has taken many of the Boulder dam pictures that have appeared in *Construction Methods*.



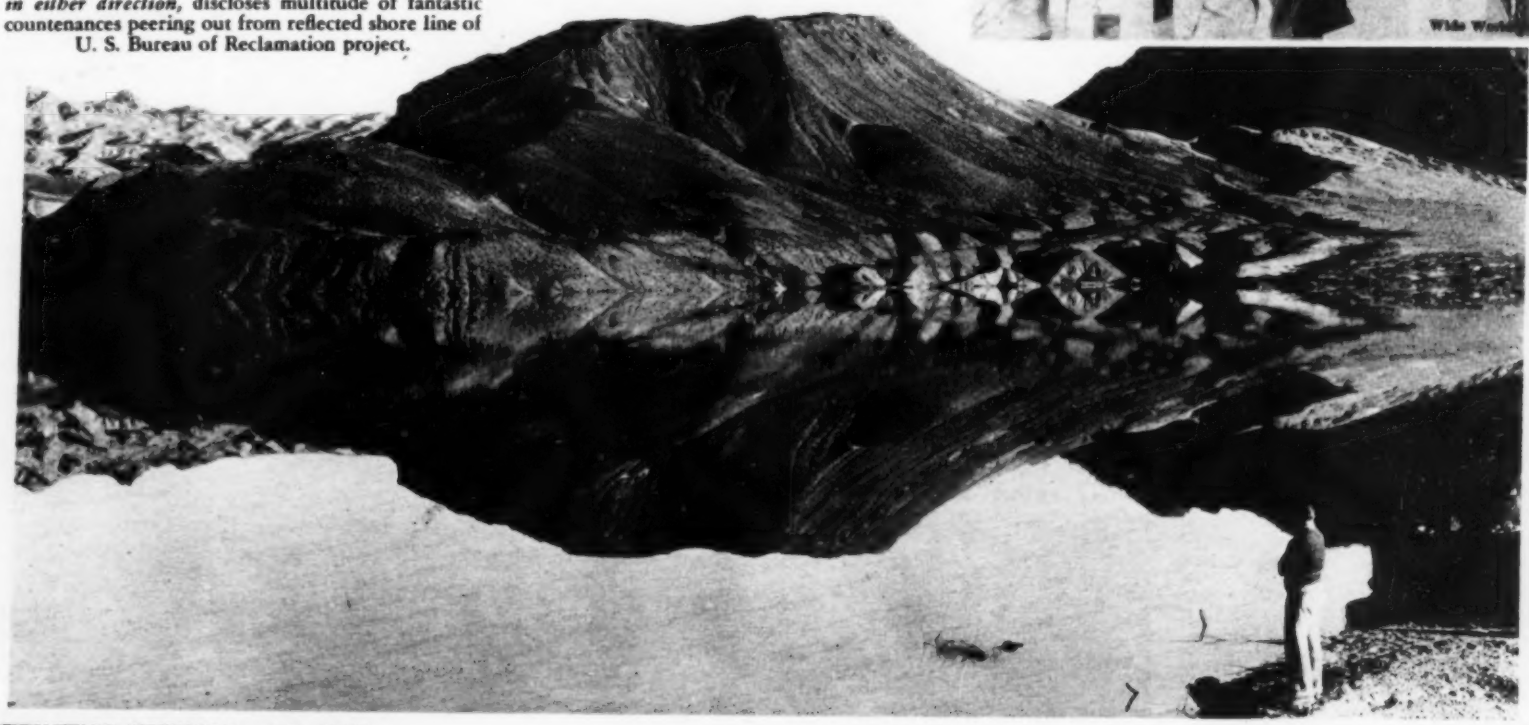
RIVER TO BE MOVED UNDER BRIDGE. Built across dry land at South Omaha, Neb., 1,050-ft., two-span continuous steel truss was erected by Kansas City Bridge Co., using cantilever method, prior to shifting of Missouri River from east to west side of valley into new channel under structure. River channel was moved by constructing permeable dikes above and below bridge site.

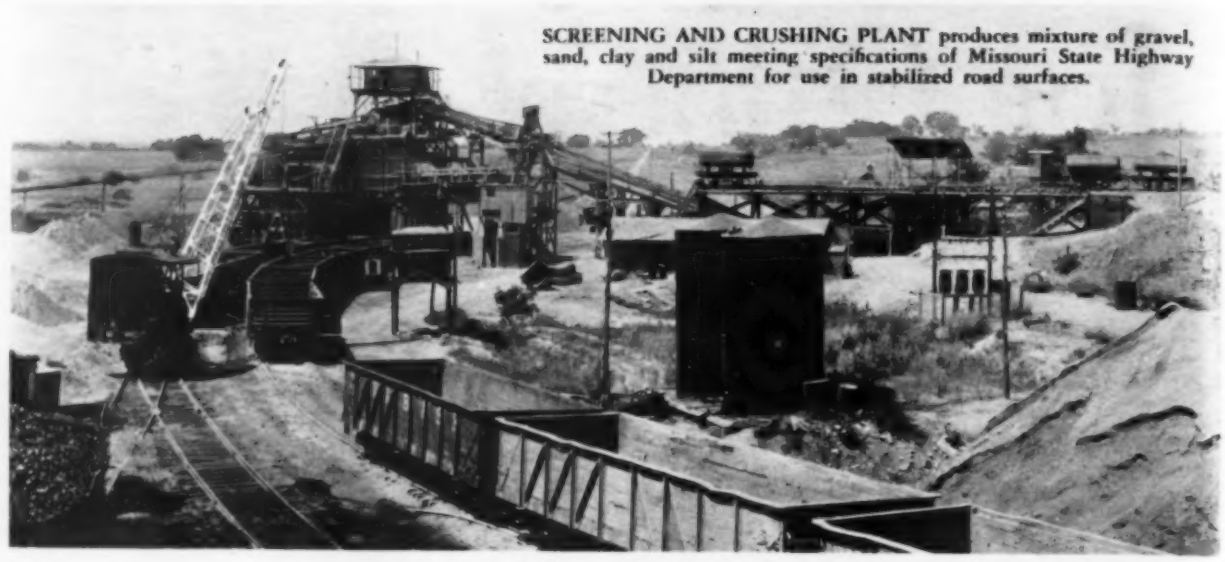
ATOP WASHINGTON MONUMENT. *(Right)* Engineers of U. S. Coast and Geodetic Survey make unique theodolite setup to fix, by triangulation, exact geographical location of tip of famous 555-ft. shaft in nation's capital. Official location: 38 deg., 53 min., 21.681 sec. in latitude and 77 deg., 2 min., 7.955 sec. in longitude.



Wide World Photo

A SEA OF FACES. *(Below)* Water of lake formed by Boulder dam on Colorado River mirrors Arizona hills in striking photograph which, *turned sideways, in either direction,* discloses multitude of fantastic countenances peering out from reflected shore line of U. S. Bureau of Reclamation project.





SCREENING AND CRUSHING PLANT produces mixture of gravel, sand, clay and silt meeting specifications of Missouri State Highway Department for use in stabilized road surfaces.

Stabilized Gravel Mix

Produced at Plant for Road Surfacing

MARKING an important advance in the method of constructing stabilized gravel surfaces, (see *Construction Methods*, August, 1934, pp. 48-50) the Cooley Gravel Co., of Chillicothe, Mo., has demonstrated the practicability of producing at the plant a stabilized mixture meeting state specifications and ready for application to the road. Heretofore, practically all stabilized surfaces have been constructed by the road-mix method. Using clay from the overburden as an admixture to the pit-run gravel, the company early in April began producing a stabilized mixture which conformed to the rigid requirements as to the proportions of clay, sand and aggregates properly graded for the stabilized mix. Output in April exceeded 23,000 tons with daily production reaching 2,200 tons under the most favorable conditions.

Gradation of Material—Specifications for a stabilized mixture call for a definite gradation of the size of the aggregates and fines in proper proportion, and for a definite plasticity of the material as indicated by soils tests. The plastic quality of the mixture is largely determined by the clay content. Recommendations of the Calcium Chloride Association on the gradation of the materials in the stabilized mix are closely followed by the Missouri State Highway Department in its stabilization work with a preference for the lower limits in each case. These specifications call for the composition limits by weight shown in table 1.

BY SCOOPING BUCKETFUL OF OVERBURDEN SOIL at proper intervals, 3½-yd. dragline maintains desired proportions of gravel and clay.

Table 1 — Specified Composition

GRADATION	PER CENT
Passing 1-in. sieve	100
Passing ¾-in. sieve	80—100
Passing ⅜-in. sieve	50—100
Passing No. 4 sieve	40—80
Passing No. 10 sieve	30—60
Passing No. 40 sieve	20—45
Passing No. 270 sieve	10—25

The plasticity test is made on the fraction of the material passing the No. 40 screen, and the plasticity index may vary from 6 to 14.

In most stabilization work up to the present the desired mixture has been obtained by supplying materials to the road on which gradation and plasticity tests have been made, and the varying quantities of the clay, sand and gravel needed have been computed by volume. Placed on the road, the clay is pulverized and the materials are mixed by blading. At the Cooley pit, however, it has been found possible to produce a stabilized mixture by the simple expedient of mixing the material with the dragline bucket as it is taken out of the bank, and running it through the plant.

CLAY IS MIXED WITH GRAVEL in pit by dragline bucket *(right)* before being loaded into cars for delivery to screening plant.

The bucket used in these operations has a capacity of 3½ cu.yd. By analysis and experiment it was established that a mixture of about ½ bucket of clay to 2½ buckets of pit run gravel would produce the desired mix. During the first ten days of operation several carloads of the material were rejected, but by combining those cars which were high in clay with those which were low and returning the material through the plant a mixture which met the specifications was produced. Once in production, and with frequent tests of the completed mixture, little trouble has been experienced in holding the material to specifications. Table 2 shows the composition of an average analysis of the completed mixture. The plasticity index of the material varies from 8 to 13.

Table 2 — Composition of Completed Mixture

GRADATION	PER CENT
Passing 1-in. sieve	100
Passing ¾-in. sieve	96
Passing ½-in. sieve	90
Passing ¼-in. sieve	72
Passing No. 10 sieve	52
Passing No. 40 sieve	24
Passing No. 200 sieve	15

Tests of Mixture—Three soils testing engineers of the materials division of the Missouri State Highway Department, working in a soils laboratory established at the plant, run tests on the mixture. Unless a tendency toward an

STABILIZED MIXTURE is dumped by trucks in windrows along road ready for spreading and compacting.

over-abundance or lack of any material is discovered, tests are run on every other car for gradation and on every five cars for plasticity. If the material shows a tendency to approach either the upper or lower allowable limit, tests are made at greater frequency until the variation is corrected. By thus keeping a close check on the product, the mixture is kept well under control and the operator of the bucket is notified if a tendency to approach either limit is shown by the tests.

Considerable difficulty was encountered at first in obtaining the desired mix, but after several days of operation production has gone ahead smoothly. The success with which the plant was adapted to the production of this type of material is attributed to the excellent equipment and to the nature of the gravel deposit.

The gravel deposit is said to be a terminal glacial moraine. The overburden averages about 18 ft. and contains a bank of several feet of clay. The gravel surface averages approximately 35 ft. above water level. In this deposit about 50 per cent is gravel of which about one-half passes a 1-in. screen. There is considerable silt in the deposit, amounting to10 or 15 per cent of the total material. Below the water level the deposit contains a large proportion of sand. With sand, silt, gravel and clay, the materials needed for stabilization, thus available from one bank, the stabilized mixture is a logical output.

The other factor in the successful production is the equipment in the plant. Of particular importance in the production of the stabilized mixture is the fact that the dragline bucket is carried by a 125-ft. boom, which permits swinging the bucket over a wide area to obtain the various materials desired. The boom is powered by a 150 h.p. semi-diesel engine.

Pulverizing the clay, which has been accomplished on most stabilization projects by the use of rollers after the clay has been hauled to the road and allowed to dry, has been one difficulty encountered in the plant mixing, especially when the clay is wet. When dry, the clay is thoroughly pulverized by the action of the various screens and the two crushers through which the material passes in its flow through the plant. When wet, however, the larger chunks of clay sometimes must be broken up as they pass along the conveyors.

DRAGLINE WITH 125-FT. BOOM *(right)* **loads 10-yd. cars which dump into hopper under roof in foreground.**

BELT CONVEYOR *(right)* **loads stabilized material from hopper-bottom railroad car to truck for delivery to windrow along road.**

Plant Equipment — No important change in the plant was necessary to produce the stabilized material. With the pit-run gravel running naturally to approximately the proper gradation, the only screens required are 1-in. mesh to remove the oversize material which is then sent through the crusher to be broken down to proper size. A Symons 4-ft. cone crusher having a capacity of 120 tons an hour, which was a part of the regular plant equipment, is a decided advantage in speeding production. No special mixing machinery is used, the action of the grizzly, crushers, and revolving screen producing an excel lent mix.

At times, when clay, gravel and some sand from three different locations in the pit are being used, the material is given a preliminary mixing in a small pile at the bottom of the pit with the bucket. When buckets of the silty bank-run are used, the material is frequently dumped directly into the cars, with the desired amount of clay also placed directly in the cars.

Hauled to the plant in 10-yd. cars, the material is dumped through a rail grizzly with 10-in. openings into a 35-yd. track hopper. The rail grizzly eliminates the stones which are too large for the crusher until they are sledged to a smaller size.

From the track hopper the material passes over a shaker screen, the oversize material passing through a jaw crusher and rejoining the fines on the conveyor belt which runs to the top of the screening plant. Here the conveyor discharges to a 60-in. by 22-ft. revolving screen, which for the production of the stabilized mixture is equipped with only one mesh having 1-in. square openings.

Material passing the screen is chuted direct to the storage bins, while the oversize is sent to the Symons cone crusher, set at 1 in. Coming from the crusher the material passes over a vibrating screen, and any oversize is again returned to the crusher. There are no waste fines in the production of the stabilized mix.

From the storage bins the material is chuted directly into cars equipped with hopper bottoms, to be transported to a point near the roads. Under a contract with the state to supply the stabilized mixture for a considerable mileage of roads in neighboring counties, the gravel company places the materials in windrows on the road. The State highway department then proceeds with the spreading and compacting.

Production of the stabilized mixture at the gravel plant was supervised at its inception by C. G. Cooley, president and general manager of the company, who designed the present equipment of the plant following its purchase by his company in 1929. W. C. Davis, soils engineer of the Missouri State Highway Department, was in charge of the tests during the experimental stages.

When the gravel company completes its contract, the material is windrowed along the shoulders of the road on which it is to be used. The material is placed at the rate of 528 cu.yd. to the mile to provide a 1½-in. mat over the existing gravel road. It is allowed to remain in the windrows until the roadway is damp from rains. It is then spread with a blader and compacted by traffic. The result is a well-bound mat which is used either as a base course for bituminous construction or is maintained with calcium chloride as a stabilized surface.

AFTER MIXTURE HAS BEEN SPREAD at rate of 528 cu.yd. per mile, it is compacted by traffic to provide 1½-in. surface mat.

ELECTRICALLY WELDED TRUSS BRIDGE across Rancocas River in Burlington County, N. J., has 160-ft. swing span, erected in open position, and two symmetrical approach spans each 112 ft.-8 in. long.

400-Ft. All-Welded Bridge

Includes 160-Ft. Swing Span

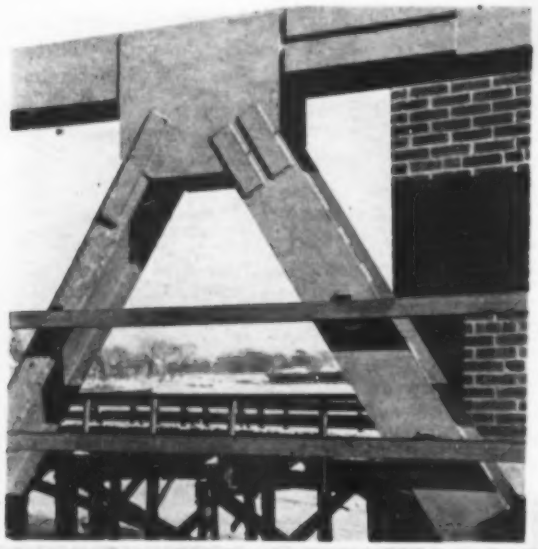
WHAT IS believed to be the longest all-welded truss bridge in the United States now is being completed across the Rancocas River between Riverside and Delanco, N. J., for Burlington County, by the Kolyn Construction Co., of Trenton, N. J. Made up of a 160-ft. swing span flanked by two 112-ft. 8-in. approach spans, the bridge has a total length of 397 ft. between back walls on the abutments. Trusses on all three spans are spaced 38½-ft., c. to c., providing a roadway width of 36 ft. between curbs. A 5-ft. sidewalk on one side of the bridge is supported by welded brackets. The new structure replaces an inadequate highway bridge at the same site.

Design of the structural frame follows ordinary practice for small riveted bridges, with fillet-welding substituted for riveting at the connections. Except for a pair of riveted plate girders under the operating machinery at the center of the swing span, the entire structure was fabricated by electric arc welding both in the shop and in the field. Total weight of structural steel in the bridge is about 450 tons.

Rolled sections were utilized for both chord and web members of the trusses. Where necessary, web members were built up by welding plates to the flanges. Structural connections were made with steel gusset plates and straps welded to the flanges of the intersecting members, as illustrated by accompanying photographs.

Approach-span trusses were fabricated in complete units and each of the swing-span trusses was fabricated in three sections by electric arc welding in the Ambridge, Pa., shops of the American Bridge Co., which executed a subcontract for the steelwork. The trusses and all other steel were shipped by rail to the Delaware River and transferred to barges for transportation to the site. Three derrick boats, one of which was a large-capacity unit with a long boom, erected the trusses on piers and falsework. Field welding was sublet by the steel contractor to the J. K. Welding Co., Inc., of Long Island City. Both shop and field welds were made with Lincoln Fleetweld covered electrode.

Personnel—Operations of the Kolyn Construction Co., of which M. D. Kolyn is president, were directed by Albert Mattson, a partner in the firm. R. L. Streeter was superintendent in charge of erection for the American Bridge Co. Field welding was supervised for the J. K. Welding Co., Inc., by J. L. Ryan.



TRUSSES *(above)* are built up of rolled sections with welded connections. WELDER *(in oval)* deposits fillet at splice in top chord of swing span.

WELDING *(above)* is employed for splices, panel-point connections, and built-up flanges of web members.

TEMPORARY TRESTLE with draw span (on far side of all-welded bridge) carries traffic during construction period.

WELDED TRUSS CONNECTIONS *(above)* utilize plates and straps in variety of combinations.

Present and Accounted For —

A Page of Personalities

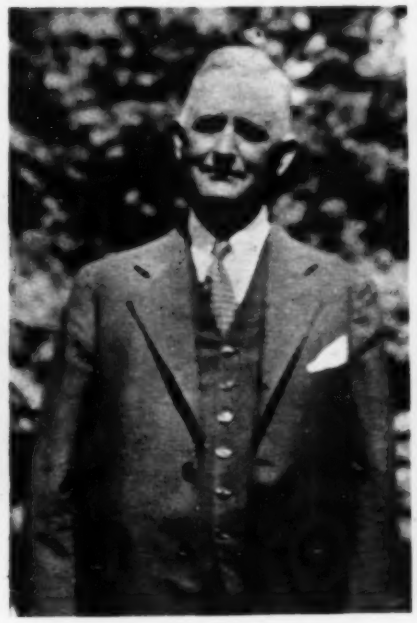
ROSS WHITE, who has served as superintendent of construction at Norris dam since that project was begun, has been promoted to the position of general construction superintendent for all three of the Tennessee Valley Authority's major projects, including Norris dam, Wheeler dam and Pickwick Landing dam. Mr. White's construction experience includes service on the Pine Canyon dam for the Pasadena (Calif.) Water Department, Don Pedro dam, Exchequer dam, Abitibi and Chute-a-Caron dams in Canada. He is a native of Florida and a graduate of Iowa State College.

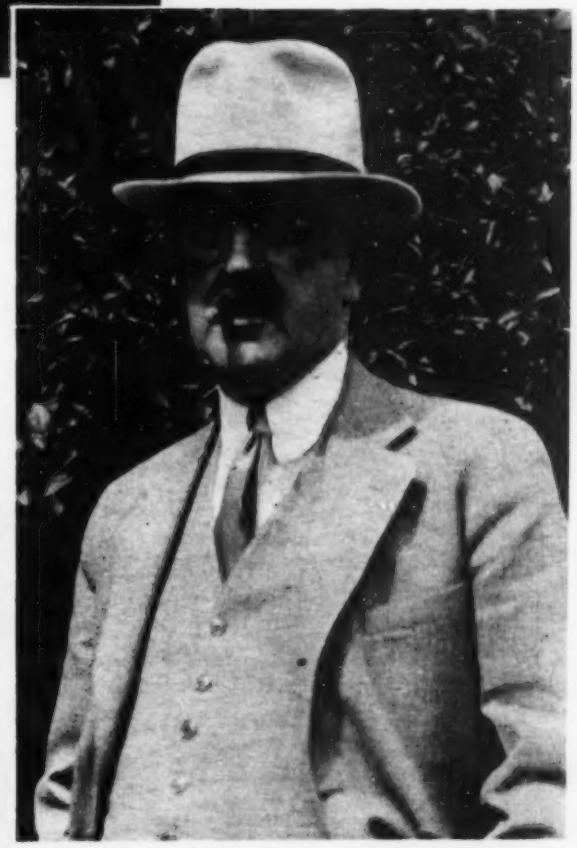
A. R. CLAS, Chicago architect, formerly assistant director, has been named director of the Housing Division of the Public Works Administration at Washington, D. C., succeeding Col. Horatio B. Hackett, recently appointed assistant administrator of PWA.

LEE G. WARREN, construction manager of the Frederick Snare Corp., of New York City, is in charge of building the $6,249,000 Tygart dam at Grafton, W. Va., a 235-ft. concrete structure 1,850-ft. long, constituting one of a series of dams in flood control plan for headwaters of Ohio River.

FRED I. ROWE, of the W. L. Johnson Construction Co., of Hicksville, Ohio, has been selected to serve as chairman of the Highway Division of the Associated General Contractors of America.

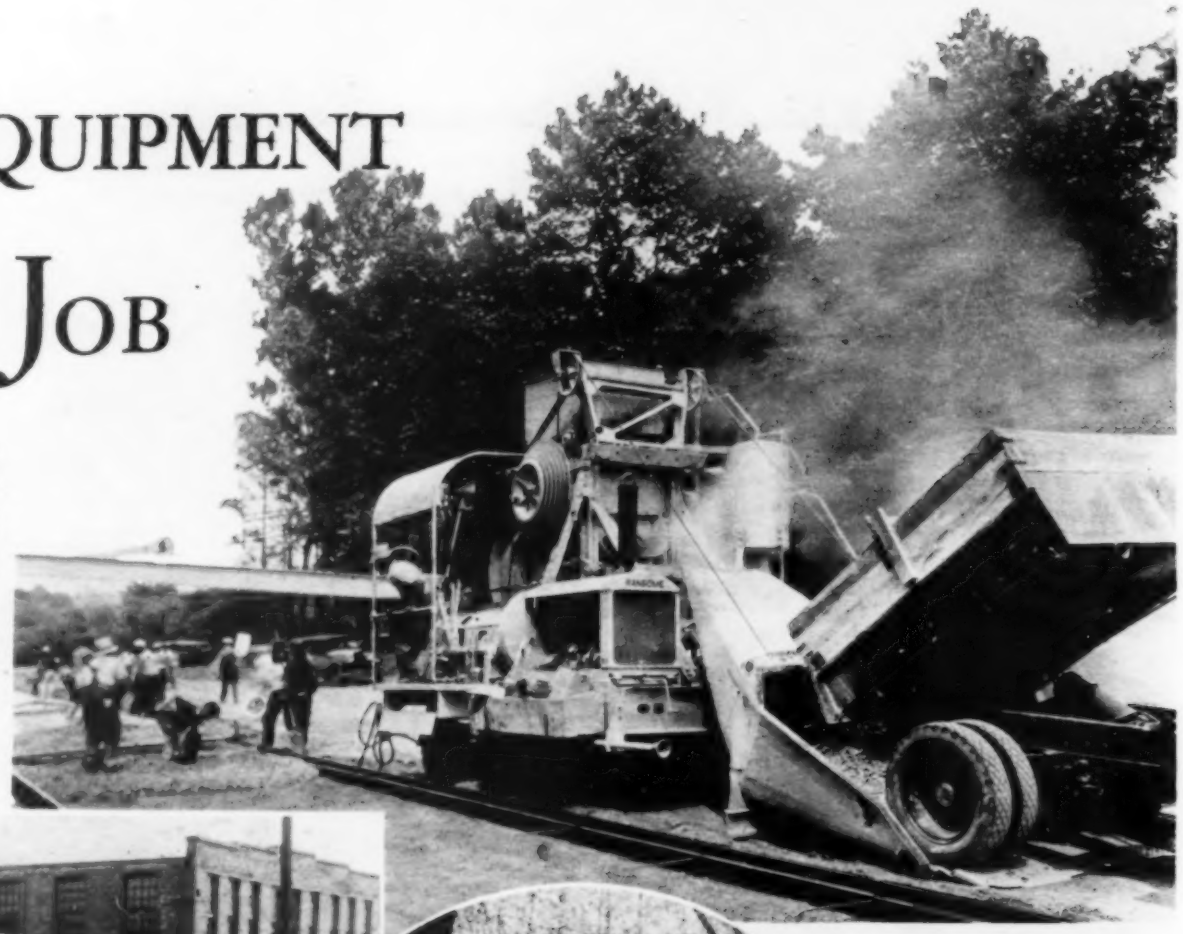
C. J. LOWRANCE, levee building contractor of Driver, Ark., is the new president of the Mississippi Valley Flood Control Branch of the Associated General Contractors of America.





E. C. SUTCLIFFE, vice-president of Warren Bros. Co., Cambridge, Mass., specialist in bituminous road construction, has been elected president of the Highway Contractors Division of the American Road Builders' Association. Mr. Sutcliffe took a leading part in the recent organization of the National Bituminous Pavers Industrial Association.

NEW EQUIPMENT ON THE JOB



GREATER HORSEPOWER (75 hp. at 1,200 r.p.m.); longer boom (increasing travel of bucket 5 ft.); auxiliary water tank; larger pipes from tanks to drum, (increased from 3 to 4 in.); simplified countershaft construction; larger clutches and trouble-proof crawler construction—these are outstanding improvements in new model paver *(right)* which, manufacturers claim, has maintained an hourly average of approximately 39 batches for 11 hr. continuous operation on 1¼-min. mix. Semi-circular, two-piece discharge chute completely out of drum during mixing period. Discharge time, 8 to 10 sec.—Ransome Concrete Machinery Company, Dunellen, N. J.

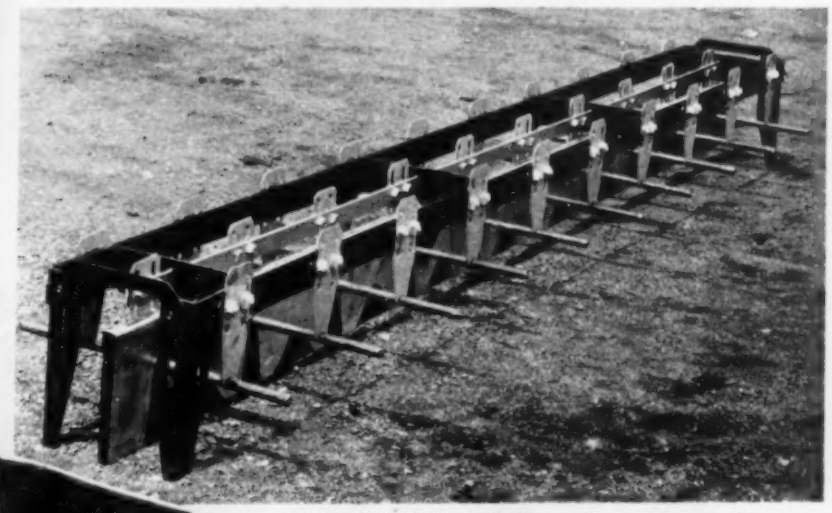
BUILT FOR MORE WORK from available air, these busters are made in three sizes. Largest weighing 84 lb. handles hardest concrete breaking jobs, thickest pavements and walls. Medium size buster (77 lb.) does effective work on thinner concrete pavements and walls and on jobs where much moving around is necessary. Smallest size (46½ lb.) is handy in close quarters — narrow trenches, tunnels and in lighter demolition. Particularly valuable where supply of air is limited. Each model has but three moving parts—valve, piston and striking block — and is air-cushioned and cushioned with side-rod springs, making operation easy.—Sullivan Machinery Co., 400 N. Michigan Ave., Chicago, Ill.

FOR BRIDGE WORK, caissons, large excavations, irrigation and other service requiring continuous operation, this heavy-duty 4-in. self-priming centrifugal pump *(left)* has been designed. Improvements:—100-per cent automatic priming; improved grease seal; heavy-duty, wide-blade trash-type adjustable impeller; pumps 1⅝-in. solids. Lifting bails, suction strainers and vacuum gages standard equipment. Powered by 4-cylinder Waukesha gasoline engine developing from 17 hp. at 1,500 r.p.m. to 30 hp. at 2,000 r.p.m. Mounted on heavy-duty trucks, equipped with 18-in. disk wheels and 4-in. wide tires.—Sterling Machinery Corp., 411-13 Southwest Boulevard, Kansas City, Mo.

AIR-POWERED SCOOP, a late development in earth-moving equipment, digs any depth up to 12 in., dumps at any angle up to 90 deg. and spreads any depth up to 25 in. Its distinctive features are: (1) Self-powered (requires no changes or attachments on tractor); (2) air-operation provides maximum speed in digging and spreading; (3) 18-in. bowl clearance in carrying position—important when working over irregular or soft ground.—Midwest Piping & Supply Co., Inc., 1450 S. Second St., St. Louis, Mo.

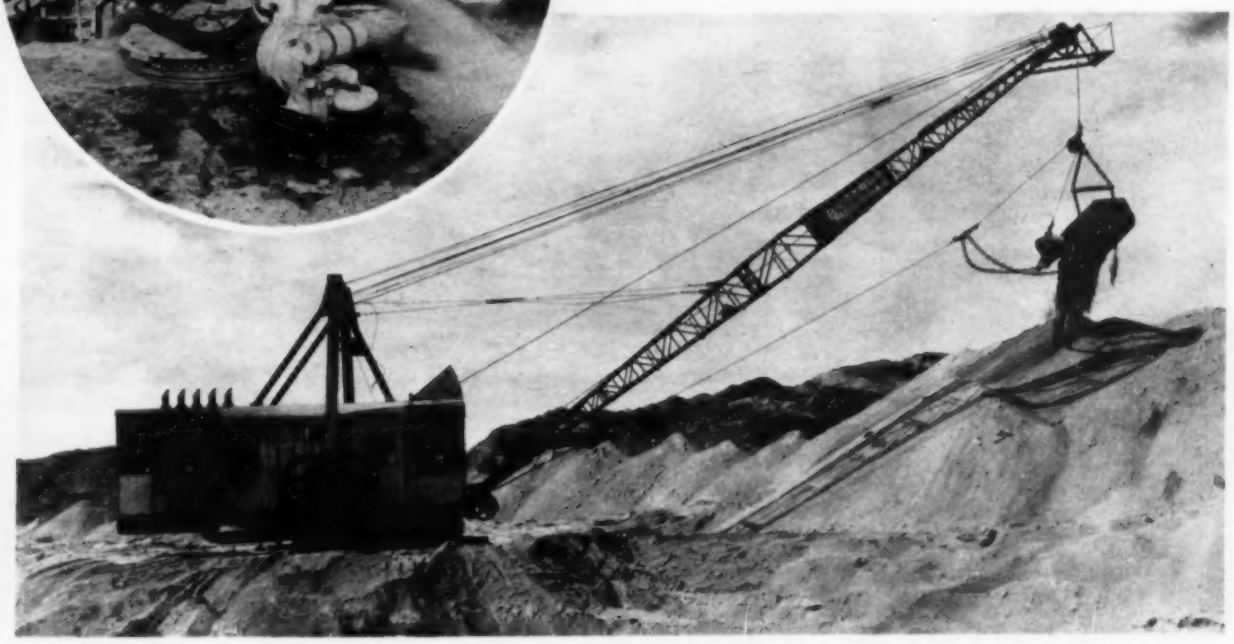
SOLID BOX-TYPE FRAME of this leaning wheel-grader *(below)* assures strength and rigidity because box construction will not yield to twists as do most conventional frames; blade is held rigidly to cut. Blade's narrow width permits it to be swung through arc of 90 deg. from ditching position to perpendicular without any adjustment of lift links. Operator, from his position on platform, can see entire length of blade and can always observe work he is doing and what is ahead of him. New-type drawbar has blade reversing adjustment (on power-controlled machines) which is self-locking in any position. Angle of blade can be adjusted while blade is in ground. Available in 10- and 12-ft. models.—J. D. Adams Co., Indianapolis, Ind.

HIGH-SPEED earth hauling unit, built to transport 6- to 8-yd. loads as fast as 16 mi. an hour, consists of trailer-type wagon and tractor equipped with six 18x60-in. low-pressure tires. Drive wheels carry part of load weight, assuring ample traction under all conditions. New type of cushioned hitch provides unusual stability without sacrificing flexibility. Machine can "turn on dime" at greater than 90-deg. angle. Wide, unobstructed bottom-dump mouth for discharging loads and open hopper top for low loading are other features.—Allis-Chalmers Tractor Division, Milwaukee, Wis.



COMBINATION DOWEL, tiebar and expansion joint spotter holds expansion joints in vertical position; eliminates necessity of supplying stakes to hold dowel bars in place and keeps them parallel. Thus, concrete slabs have free movement when expanding and contracting and no breakage occurs at point behind dowel bars. Spotter frame is loaded alongside road and carried in place. Movement of series of cams releases all materials, permitting withdrawal of frame and reloading. A saving of time and money is promised by manufacturer to users of this unit.—Flexible Road Joint Machine Co., Warren, O.

ONE MAN can easily carry this self-priming, centrifugal 3-in. pump *(right)* which weighs 88 lb. complete with a built-in, air-cooled gasoline engine. This unit will handle muddy water or solids, has capacity of 15,000 gal. per hour and a guaranteed suction lift of 28 ft. Main parts made of special abrasion-resistant aluminum alloy. High-tension, waterproof magneto shoots hot spark for starting. Manufacturer claims that 1 gal. gasoline will pump 35,000 gal. of water—Homelite Corp., 73 Riverdale Ave., Port Chester, N. Y.



COMPACTNESS and unusually low bearing pressure are two features of this Bucyrus - Monighan new - model walking dragline *(right)*. Center portion of revolving frame with all principal machinery in position is shipped as a unit in one car, thus permitting speedy unloading and assembling. Swing mechanism and fuel oil tanks are below deck and machine is so balanced that little dead counterweight is required, thus eliminating excess weight and reducing ground bearing pressure to 4½ lb. per square inch. Sensitive controls permit rapid operation. — Bucyrus-Erie Co., South Milwaukee, Wis.

BETTER FOR DUMP TRUCKS?

Of course! Here's why—

Here's a tire that will do your work better. It's the Goodyear Dump Truck All-Weather—built to do the kind of work your dump trucks do.

Examine it. Try it. Judge it in the light of your own tire requirements. Judge it from the standpoint of performance. Judge it from the angle of long, dependable service. Judge it on the basis of cost-per-mile operation. Judge it any way you like—no other tire can give you so much.

Better for dump trucks? Of course! They're *built* for dump trucks. Goodyear Dump Truck All-Weathers give you:

- **BETTER TRACTION**—the grip and pulling power of that famous All-Weather tread . . . the tread that has proved itself in over twenty-five years' service.
- **SIDE-WALL TRACTION**—heavy rubber side-wall ribs for protection and added traction in ruts.
- **GREATER STRENGTH, DURABILITY**—because of Supertwist cord—the best cord ever developed for truck tires.
- **LONGER LIFE**—rubber in both body and tread is specially-toughened to resist heat—to wear longer.
- **EXTRA-STRONG BEAD CONSTRUCTION**—strength for heavy, swaying loads.

Give Goodyear Dump Truck All-Weathers a chance to show you what tire performance really is. Let them prove to you they're MONEY SAVERS.

CALL THIS MAN

He is the Goodyear Truck Tire Man. He represents the most complete line of truck tires made. Behind him are all the years of Goodyear's experience in the design and application of truck tires for every type of business—for every job. He'll pick the RIGHT tires for your trucks. His services cost you nothing. He'll save you money.

SEE THIS TIRE

It's the famous Goodyear Dump Truck All-Weather. It's the most scientifically designed tire built for dump truck work. It represents years of experience in tire building by the world's largest builder of truck tires. It's a MONEY SAVER.

THE GOODYEAR TIRE & RUBBER CO., INC., AKRON, OHIO

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TRUCK TIRES

money savers

SOMEWHERE, *there's always work to do...*

• And the fastest, easiest, least costly way of getting from job to job . . . whether the many small jobs that are on every big job, or on widely scattered small jobs . . . is with a Universal . . . motor truck mounted for high speed, low-cost mobility . . . Center Drive built for simplicity, speed and strength . . . 6½-8½ ton crane, or ⅜-¾ yd. shovel capacity to do a "man-sized" job efficiently, profitably.

Send for 12 page descriptive catalog, that tells, among other things, a simple way to select a suitable truck mounting.

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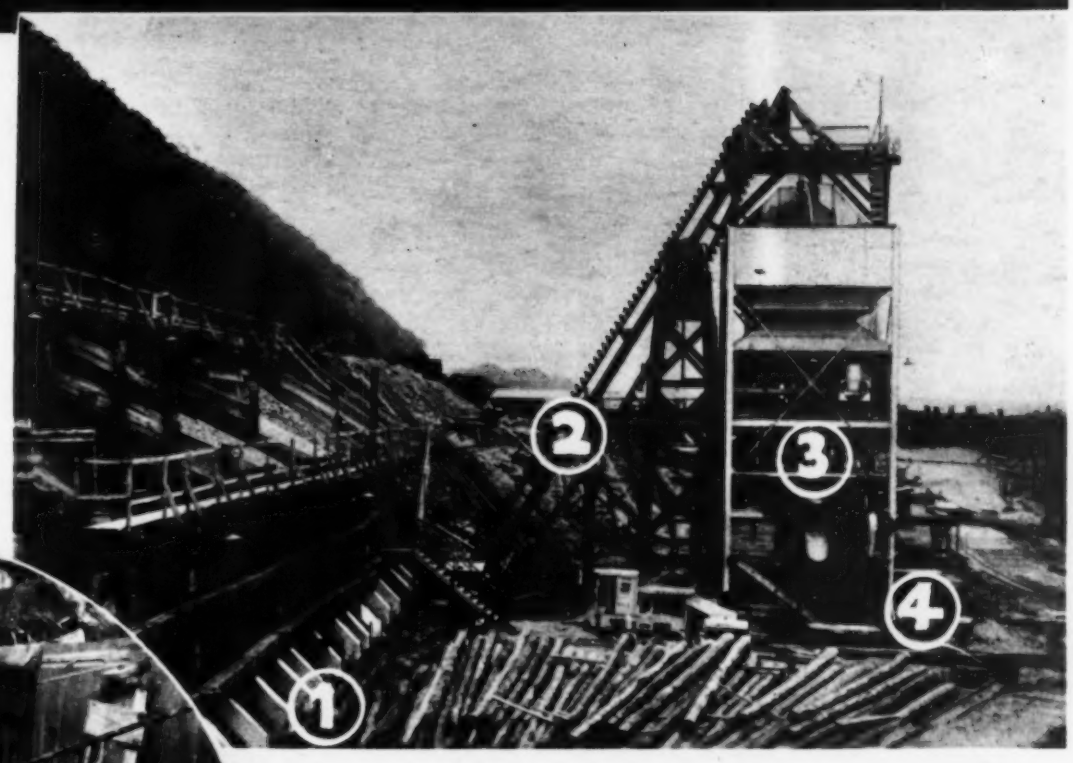
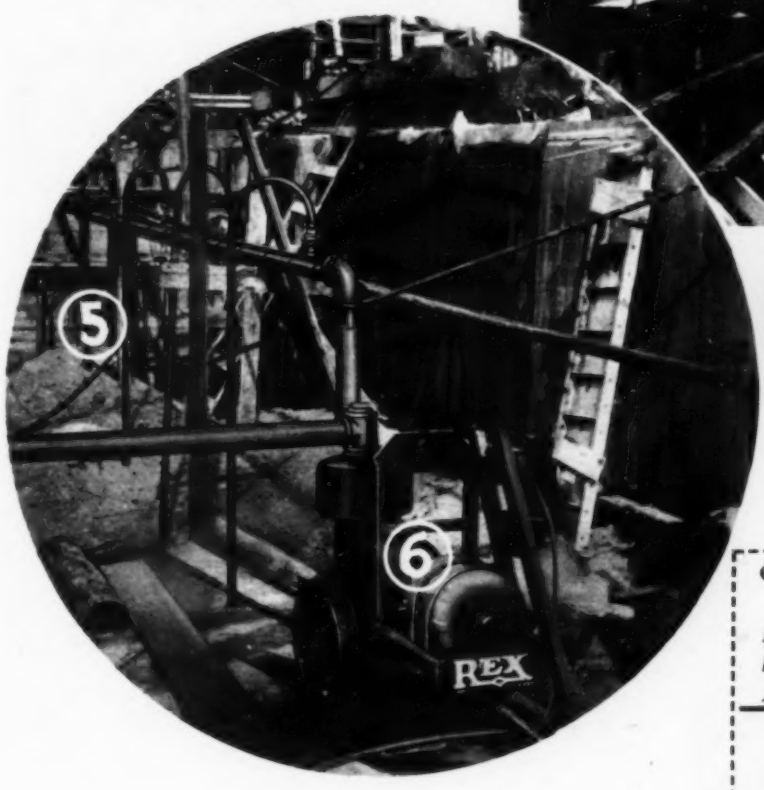
all the way with Rex—

HOW THE WALTER W. MAGEE CONSTRUCTION COMPANY HANDLED THE 80,000 YARD LOCK No. 9—MISSISSIPPI RIVER



1. Aggregates handled from storage on Rex Belt Conveyors.
2. To the batching plant on a Rex Continuous Elevator.
3. Mixed in Rex 56-S Mixers.
4. Pumped to the forms by the Rex Pumpcrete.
5. And meanwhile, well point systems—
6. with eight Rex Speed Prime Pumps keeping the hole dry.



The largest one-week pour—the best 1934 safety record of any contractor in the St. Paul District, Mississippi River—that's Walter W. Magee's record with Rex Pumpcrete and Pipe Line.

It will pay you to bid *your* next job with Rex Construction Machinery on your equipment list.

Check the coupon for the data on the equipment that interests you.

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REX CONSTRUCTION EQUIPMENT

LeTourneau EQUIPMENT moves onto PIEDMONT DAM

With LeTourneau Equipment — Buggies, Carryall Scrapers, Angledozers—come bigger yardages to Piedmont Dam, yardages such as these:

60 Yds. per Hour — 3700-Foot Round Trip Haul LeTourneau Buggies, loaded with over 30 loose yards of material, make a round trip haul of 3700 feet, a portion of it over a soft fill built across a swamp, every 21 minutes. Despite this heavy going 75 h.p. tractors travel right along with fully loaded Buggies over most of the haul in high gear, returning empty in high. Figuring but 21 pay yards to the load (a very conservative figure) each Buggy is delivering 60 yards an hour.

95 Yds. per Hour—1000-Foot Round Trip Haul A LeTourneau 12 Yard Carryall Scraper, building roadway, and travelling over the same soft fill that the Buggies cross, makes a round trip of 1000 feet every 5 minutes, delivers approximately 95 yards an hour.

Yardages such as these are typical of LeTourneau performance the country over. That's why more and more contractors are turning to LeTourneau Equipment as a means of lowering costs, upping profits.

Your Problems Are Our Problems — Write our Engineers, describing your problems; they will gladly figure with you, tell you how LeTourneau Equipment is helping others on similar work.

● Easy to Spot and Load—The Buggy maneuvers into place easily and quickly; the wide body makes careful spotting of the shovel bucket unnecessary.

● Over 30 loose yards of Fill—A 75 h.p. tractor pulls it with ease—big pneumatic tires and heavy-duty Timken bearings make the LeTourneau Buggy an easy rolling, easy manipulating carrier.

● All Out!—30 loose yards of earth completely unloaded, on the move, in half a minute—spreading too!

CONTRACTOR DESIGNED JOB PROVED

There's no "guesstimating" about the production of LeTourneau Equipment — it's tried equipment, designed by a contractor to whip his own tough jobs, proved on hundreds of projects from Portland, Me., to the All-American Canal in Southern California.

● Over a Spongy Fill with a full load — 95 yards an hour placed on a 1000-foot round trip haul.

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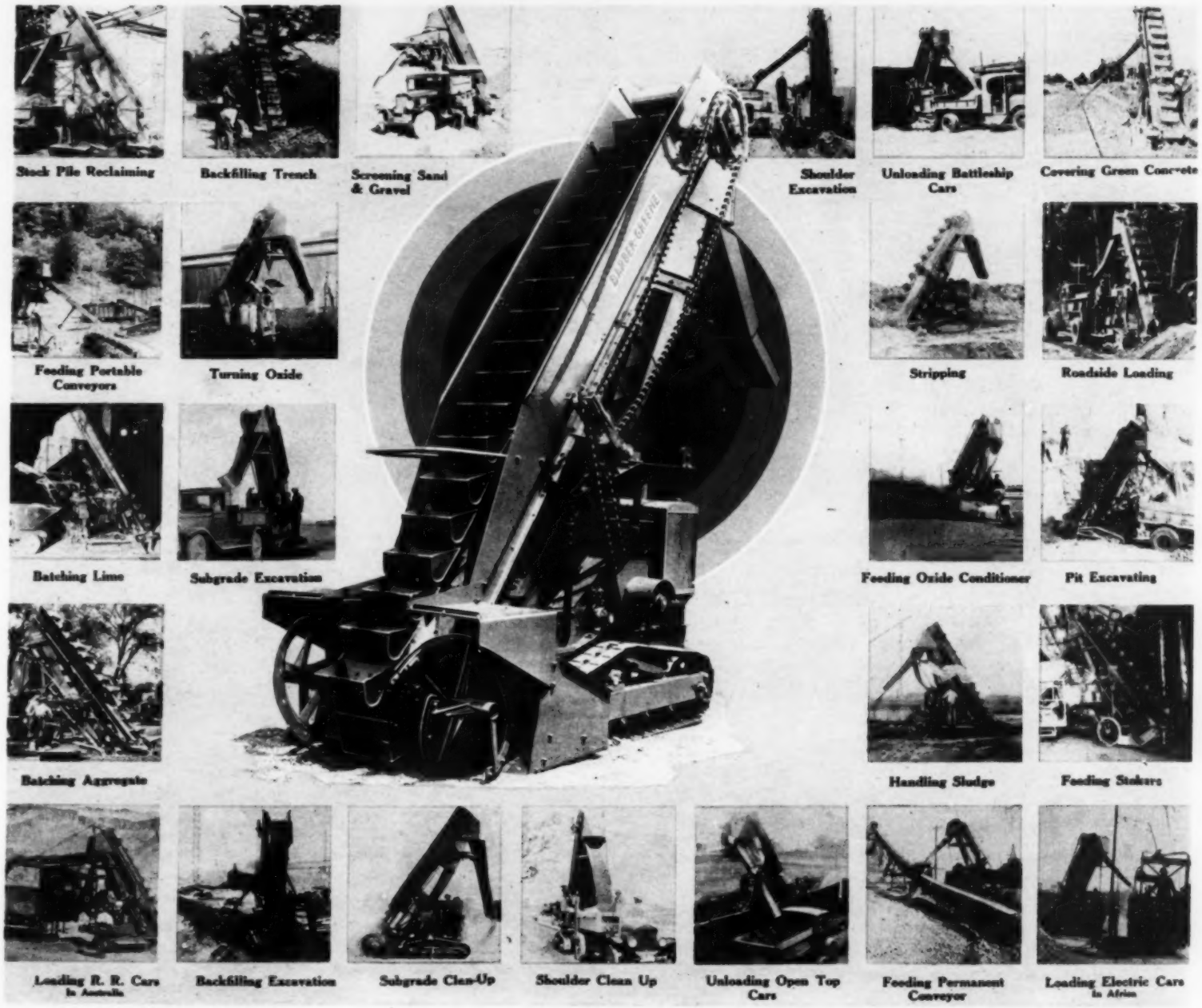
VERSATILITY

The Barber-Greene Model 82 Bucket Loader is the result of designing loaders for all these applications



NO WONDER our sales have jumped with the announcement of the New B-G 82 Loader. The above photos show a part of the B-G "proving grounds" — stretching from Africa to Australia. These are just 24 of the TWO THOUSAND B-G Bucket Loaders that have been sold.

B-G History includes the announcement of the first Loader with self feeding—first with automotive engine—first with truck type transmission—first and only with the Automatic Overload Release—first and only with the Floating Boom. The 82 makes the biggest step of all—in addition to the above features it has—SYNCHRONIZED FEEDING . . . . SLOW CROWDING . . . . KNEE ACTION . . . . TANK TYPE CHASSIS FRAME . . . . WELDED BUCKETS . . . . HARD FACING ON BUCKET LIPS . . . QUICK ACTING SELF-LOCKING SWIVEL SPOUT . . . . and many other valuable new developments. Capacity? Two to Three yards per minute (clocked at four). Price? You'll have one as soon as you hear it. Write for complete information. No obligation.

35-16

Standardized Material Handling Machines

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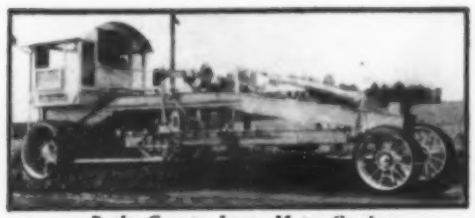
Aurora, Illinois

HOW ELKHART COUNTY CUTS ROAD MAINTENANCE COSTS

• • • • WITH AMAZING NEW TIRES

● What a difference! That's what they said when Elkhart County, Indiana, changed over a tractor from solid tires to Z-P Pneumatics.

Let the man who has been driving that tractor for a year tell the whole story. "Since we have had Goodrich Zero Pressure Tires on this tractor, I can pull through mud, sand or snow without any trouble. I've had this tractor in places that looked impossible to get through, but I always make it. I get more work done because the tractor rides easier, handles better. At the same time fuel consumption is lower." Other users report that they do four days' work in three—that they save a fourth on fuel.



Butler County, Iowa, Motor Grader

CAN'T GO FLAT

You can make similar savings. These amazing tires can't puncture—can't go flat. A giant air cavity underneath the big cleat tread cushions the load, eliminates the bouncing of air pressure tires. The lug type self-cleaning tread has 30% more traction! That's the kind of tire that gets work done in a hurry—that saves real money.

END TIRE TROUBLE

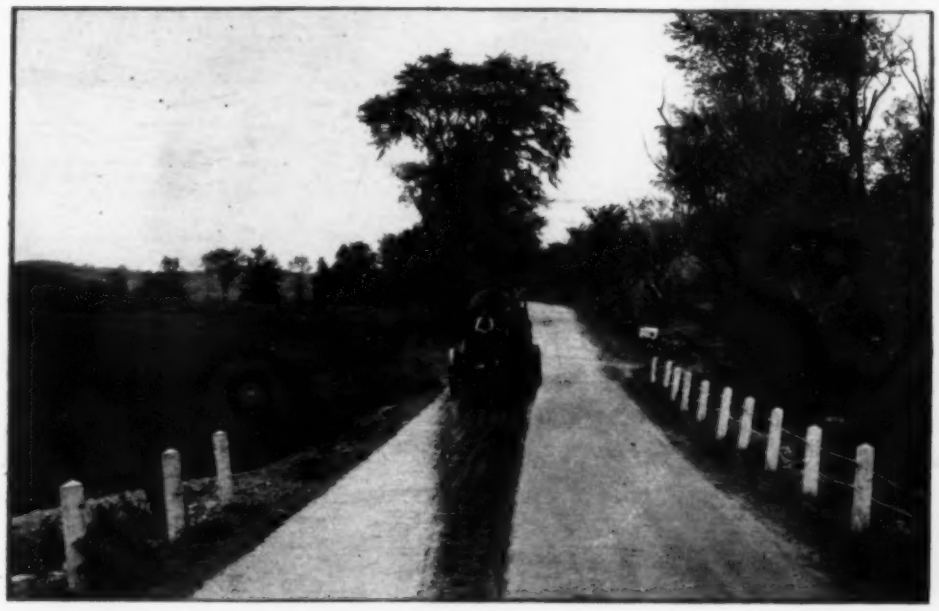
Put an end to tire troubles on graders, mowers, maintainers and tractors. Get the revolutionary Z-P (Zero Pressure) Pneumatics.

See your Goodrich Truck Tire Dealer or write for complete information on change-overs. Address Dept. Z-14, The B. F. Goodrich Company, Akron, Ohio.

Goodrich Z-P ZERO PRESSURE Pneumatic Tires

SPECIFY Z-P PNEUMATICS ON ALL YOUR NEW EQUIPMENT

KOPPERS PRODUCTS PROTECT



ELIMINATING SKIDDING BY APPLICATION OF TARMAC (AND CHIPS)

Too few people realize the importance of Tarmac surfaces in the development of safe roads. It is now possible to prove the skid-resistant character of tar surfaces and even to measure the difference between various types of surfaces. With Tarmac, new road surfaces can be built skid-resistant and old slippery surfaces can be made skid-resistant. This photo shows Tarmac being applied over an old slippery surface in New York State.

WHY DOES WOOD DECAY?

Wood decay is caused by a low form of plant life known as fungi. Fungi have fine, thread-like filaments which penetrate the wood, destroying portions of it and reducing it to a powdered or crumbled mass. The photographs on this page show one of the Koppers laboratory experiments showing how effectively creosote prevents the destructive action of fungi. Creosote treatments also prevent destruction by termites.

Typical damage done by fungus.

Agar being poured into petri dish as a medium for test.

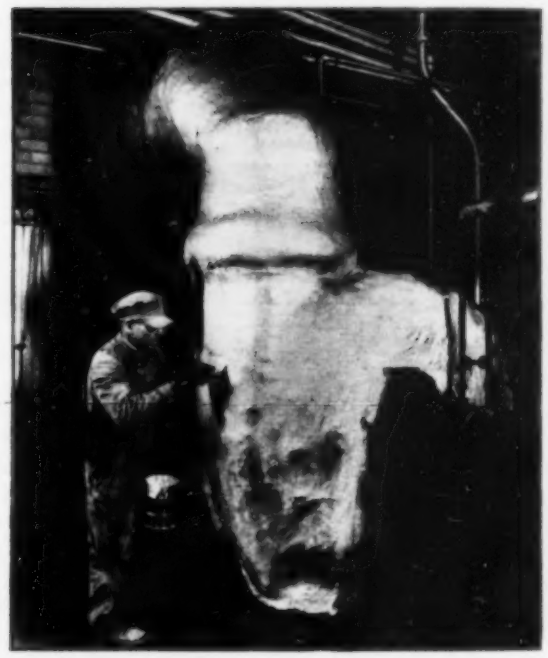
Agar being inoculated with lentinus lepideus, a fungus.

Creosoted block being placed in test dish after fungus culture had spread over the agar medium.

Creosoted block untouched by the fungus; fungus killed by the creosote. (Photo taken after three months.)

Un-creosoted block being placed in test dish after fungus had spread over the medium.

Un-creosoted block attacked and now completely covered by the fungus. (Photo taken after three months.)



INCREASING THE HEAT INSULATING VALUE OF PIPE COVERINGS

Koppers Lumino being applied to pipe insulation on the vapor system at a coke plant. Lumino increases the heat insulating value of pipe coverings, as well as beautifying the building interior and increasing the light reflection.

KOPPERS

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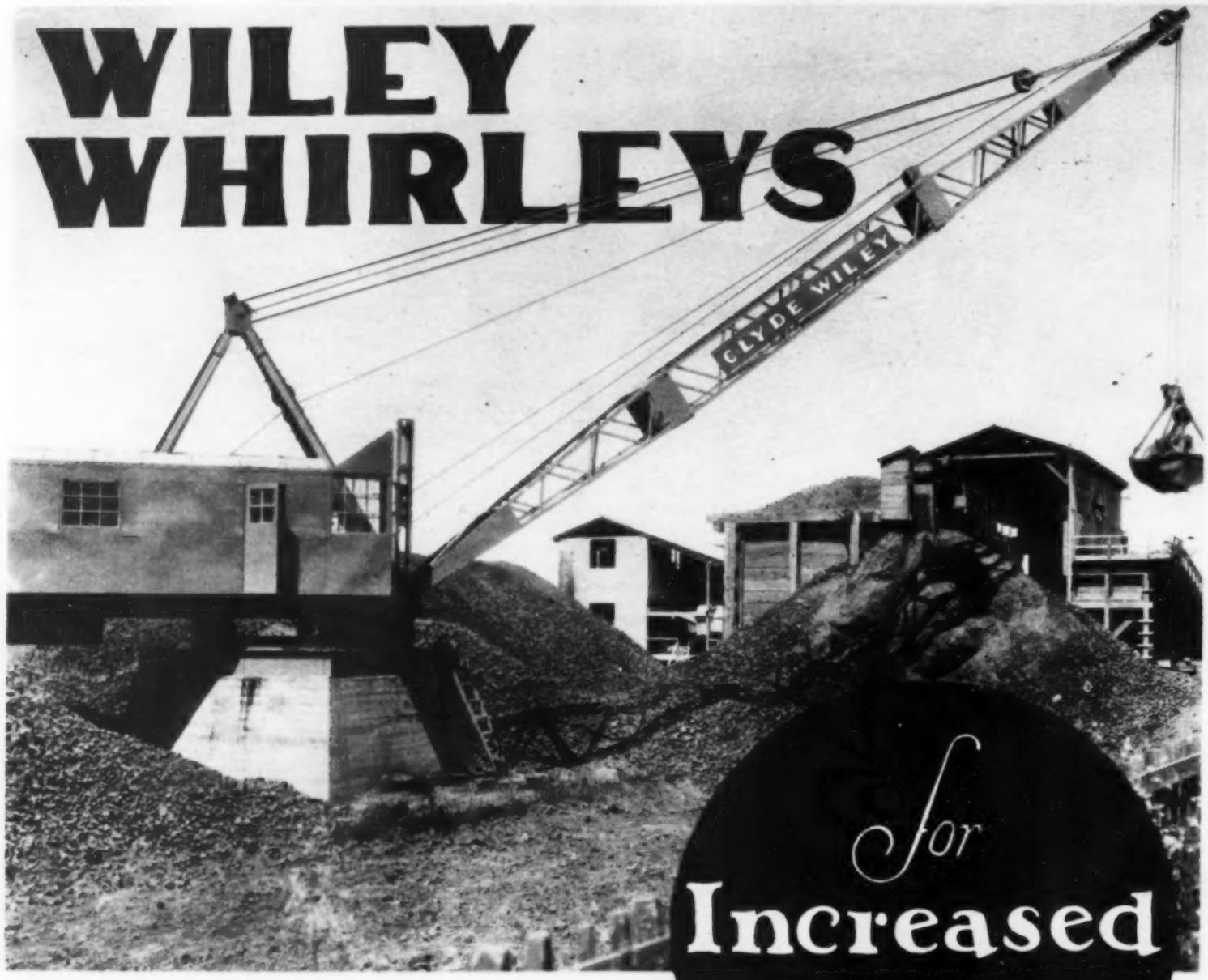

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Increased Output

In these days of keen competition and of production problems, the cost of handling materials very often becomes the deciding factor between profit and loss.

An increased output with lower cost has now become matter-of-fact wherever Clyde-Wiley Whirleys are installed. Their exceptional sturdiness, speed, flexibility and economy of operation results directly from their high quality of workmanship and materials.

Leading contractors as well as industrial plant managers have "gone Clyde" in their choice of material handling equipment.

The illustration above shows the installation of a Clyde-Wiley Whirley at the plant of the Calrock Asphalt Company, San Francisco, California.

The Clyde Sales Co., extends to you their most conscientious cooperation in the study of your problems, to assure the success and satisfaction of any installation. Write for a special bulletin on any Clyde unit for complete and detailed specifications.

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32 **TIMKEN** TAPERED ROLLER BEARINGS

NEW-modern design from crawlers to dipper—with roller bearings used wherever tests by Byers engineers have proved them practical. Both horizontal and vertical swing shafts, as well as deck rollers, operate practically friction-free in roller bearings. A quicker start on every swing adds up a lot of extra yardage in a day's work!

For the first time—crowd, travel and swing clutches also operate in roller bearings. This increases power, saves bushing wear that causes clutches to grab and chatter, eliminates costly bushing replacements.

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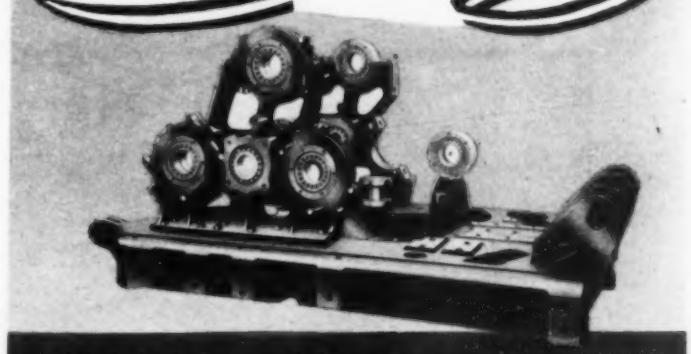
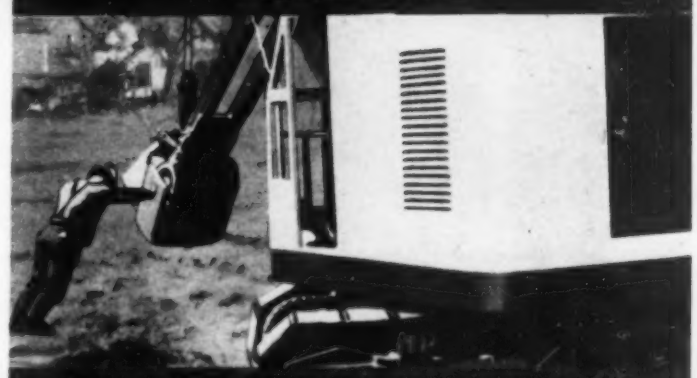
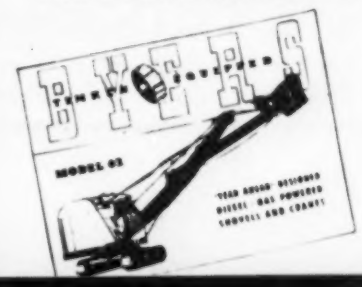


All deck shafts journaled in roller bearings — reduces friction — provides extra power for crowding, hoisting, swinging and traveling



Swing mechanism on roller bearings operates so easily one man pushing on dipper can swing entire upper deck, weighing 17,000 lbs., completely around with one hand

THE BYERS MACHINE COMPANY • Ravenna, Ohio



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MORE DIRT FASTER!

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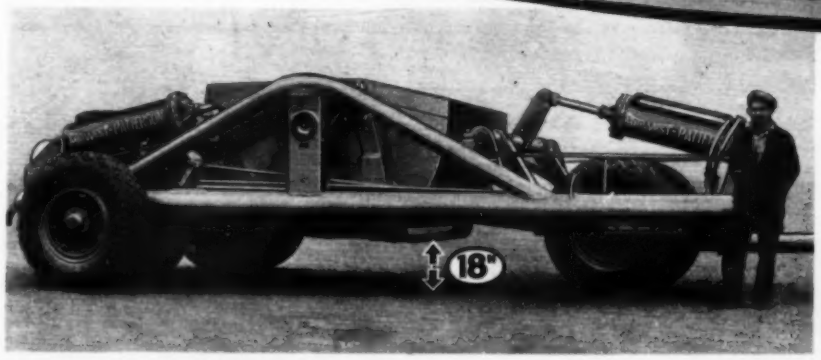
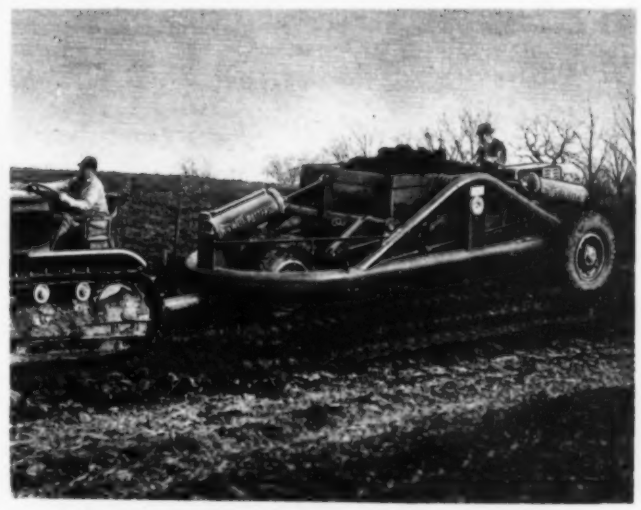


Showing 18" clearance of bowl in carrying position—an important feature when working over irregular or soft ground.



This Scoop is a self-powered unit requiring no tractor changes or attachments that reduce the power available at tractor drawbar. Air operation provides maximum speed in digging and spreading large loads like this.

"Moves more dirt faster"... that is the report of Moore Bros. Const. Co. after competitive tests on an Illinois State Highway job. Here are only a few of the outstanding features: (1) digs with less drawbar pull because of special bowl design, (2) digs any depth to 12" and depth always under accurate and immediate control of Scoop operator, (3) bowl clearance 18" in carrying position, (4) self-loading capacity 10 cu. yds. (5) exceptionally rugged construction, (6) low center of gravity, (7) dumps at any angle up to vertical, (8) spreads any depth up to 25" with fast and accurate control, (9) (10) etc. Use coupon at right for further information.

Road Machinery Division

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The Dingman books have won a wide reputation among builders and building contractors for their sound, practical and easy-to-understand discussion of building construction work. All of the material has been drawn from actual practice.

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You may send me for 10 days' free examination, the new six-volume Dingman BUILDING CONTRACTORS' LIBRARY. I agree either to return the books postpaid at the end of 10 days or send a first payment of $1.50 then and $2.00 a month for six months. CM-7-35

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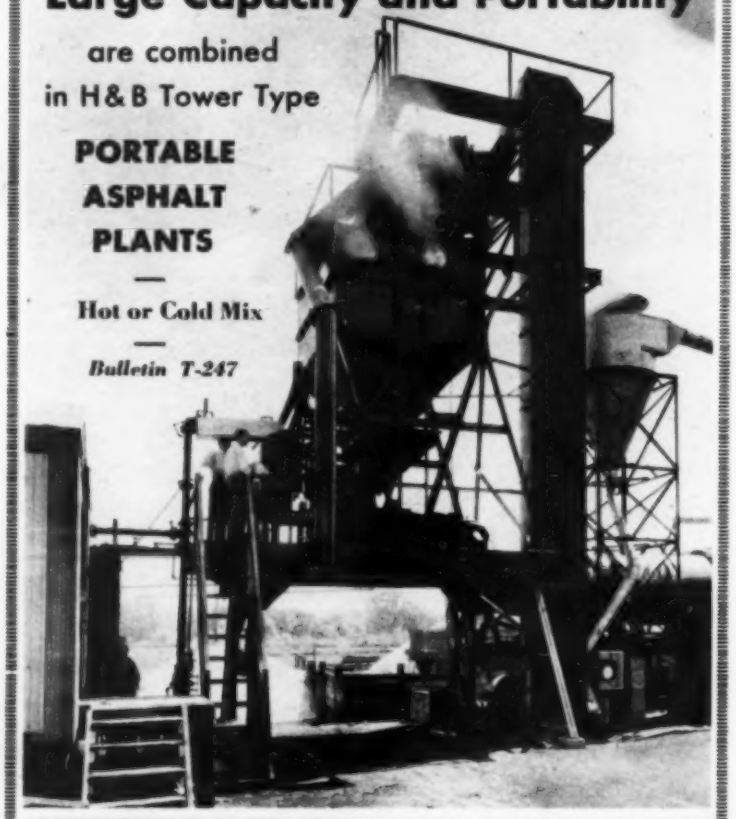

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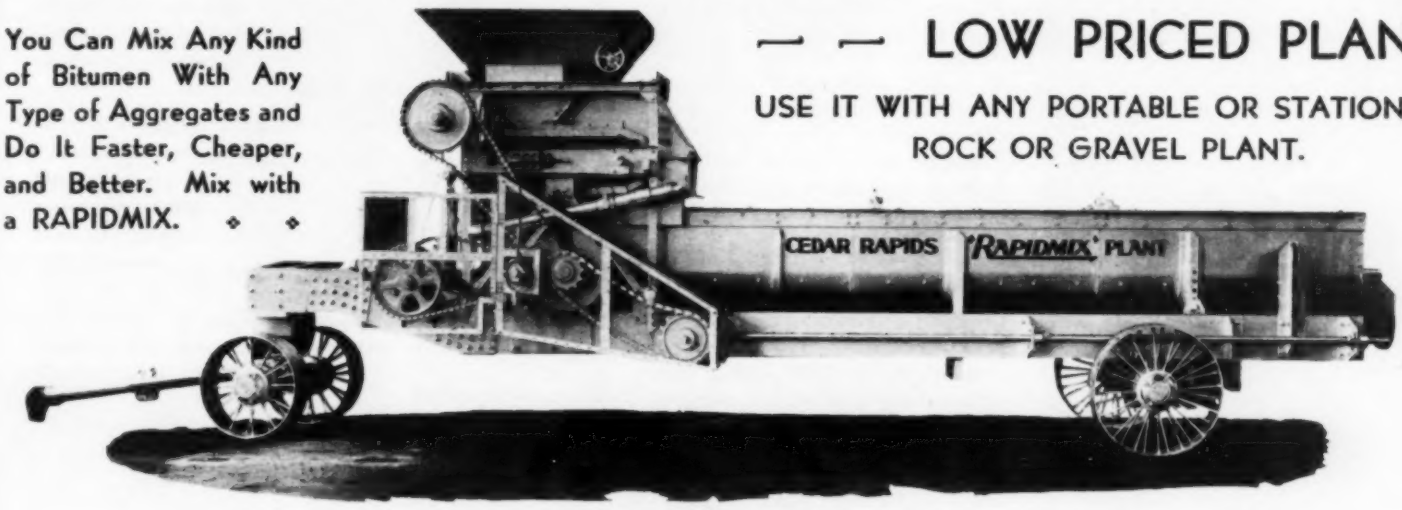
USE IT WITH ANY PORTABLE OR STATIONARY ROCK OR GRAVEL PLANT.



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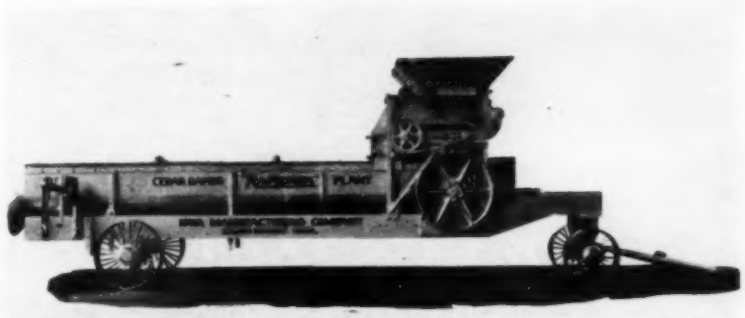
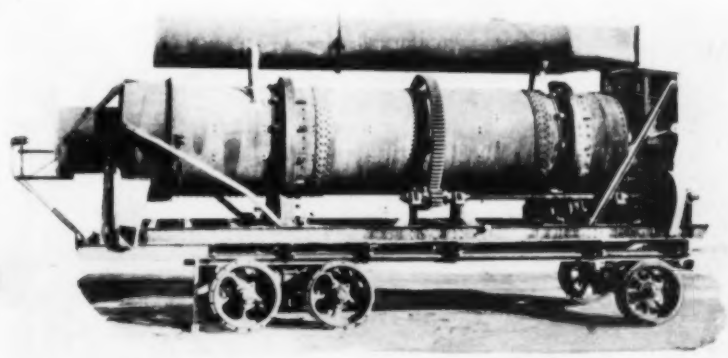
Here is the New RAPIDMIX Plant that Enables Every Road Builder to Produce an Accurately Mixed Road Surfacing Material at a Very Low Cost. It has a capacity of from 75 to 100 tons per hour— weighs complete approximately 16,000 pounds — is equipped with an accurate aggregate batcher and Kinney meter pump — pugmill is 17 feet 4 inches long and is equipped with 76 mixing paddles with renewable tips — heavy ¾ in. manganese liner in pugmill — requires 60 to 80 H. P. to operate — you can use your tractor to operate it — use any type of bitumen — a LOW PRICED plant that will give you a better, cheaper and more satisfactory Black Top Road. ❖ ❖ ❖ ❖ ❖ ❖



SIDE VIEW SHOWING DRIVES TO POWER PLANT



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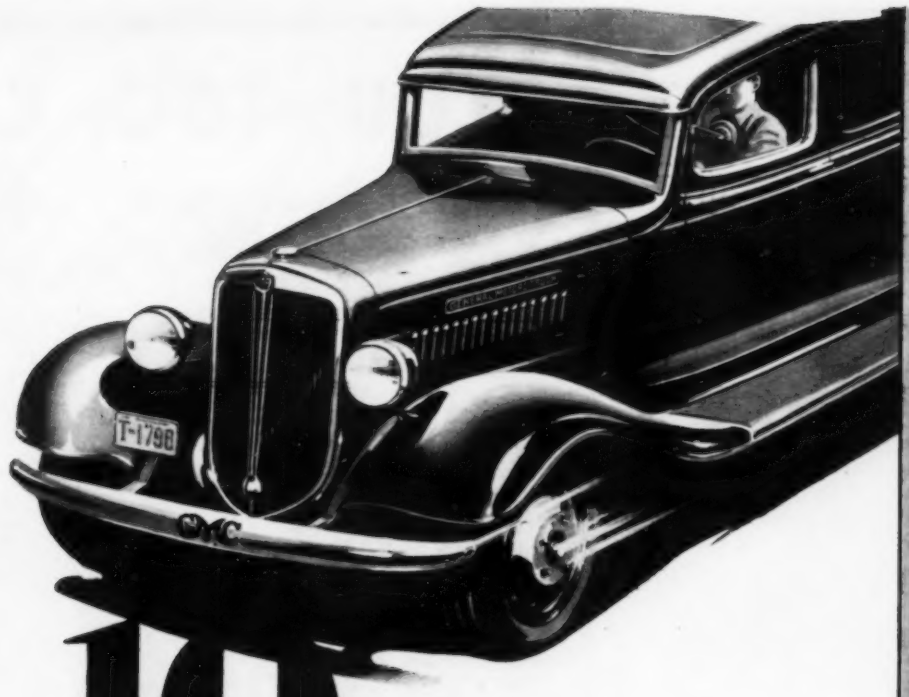

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GMC 1½-2 ton truck of value has these and 37 other money-saving advantages

In the light of your own experience and with your business and your hauling needs in mind, place your own valuation on these ten vital features of the GMC 1½-2 ton truck of value. Every one of them is important. Every one of them contributes to greater savings or improved performance or longer life. Combined they assure a degree of economy and a performance ability that not one of the other low-priced competitive trucks can match.

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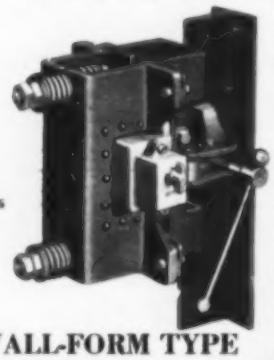

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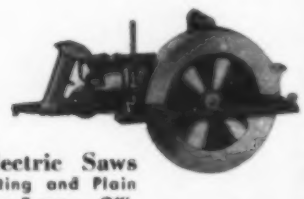

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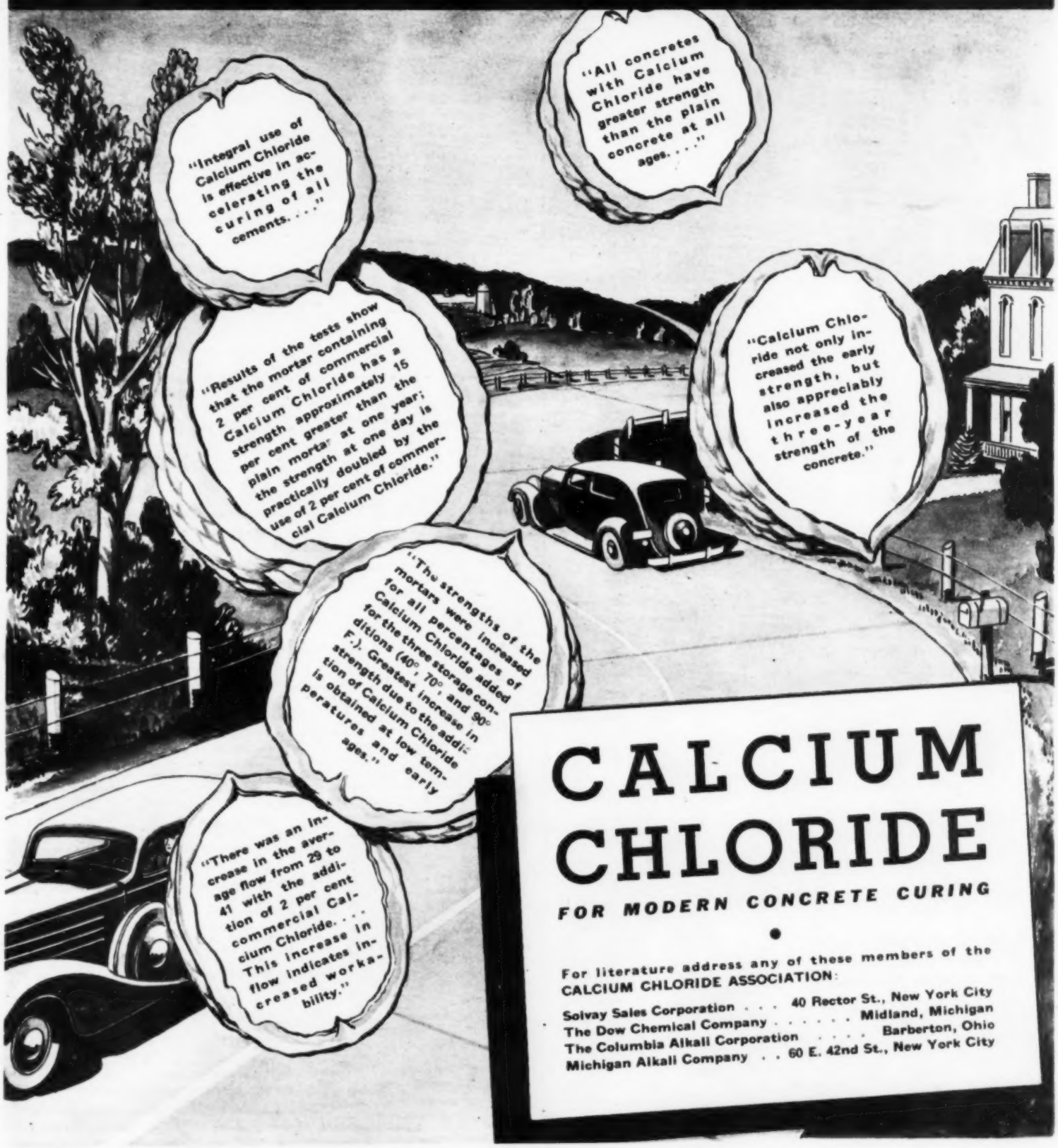

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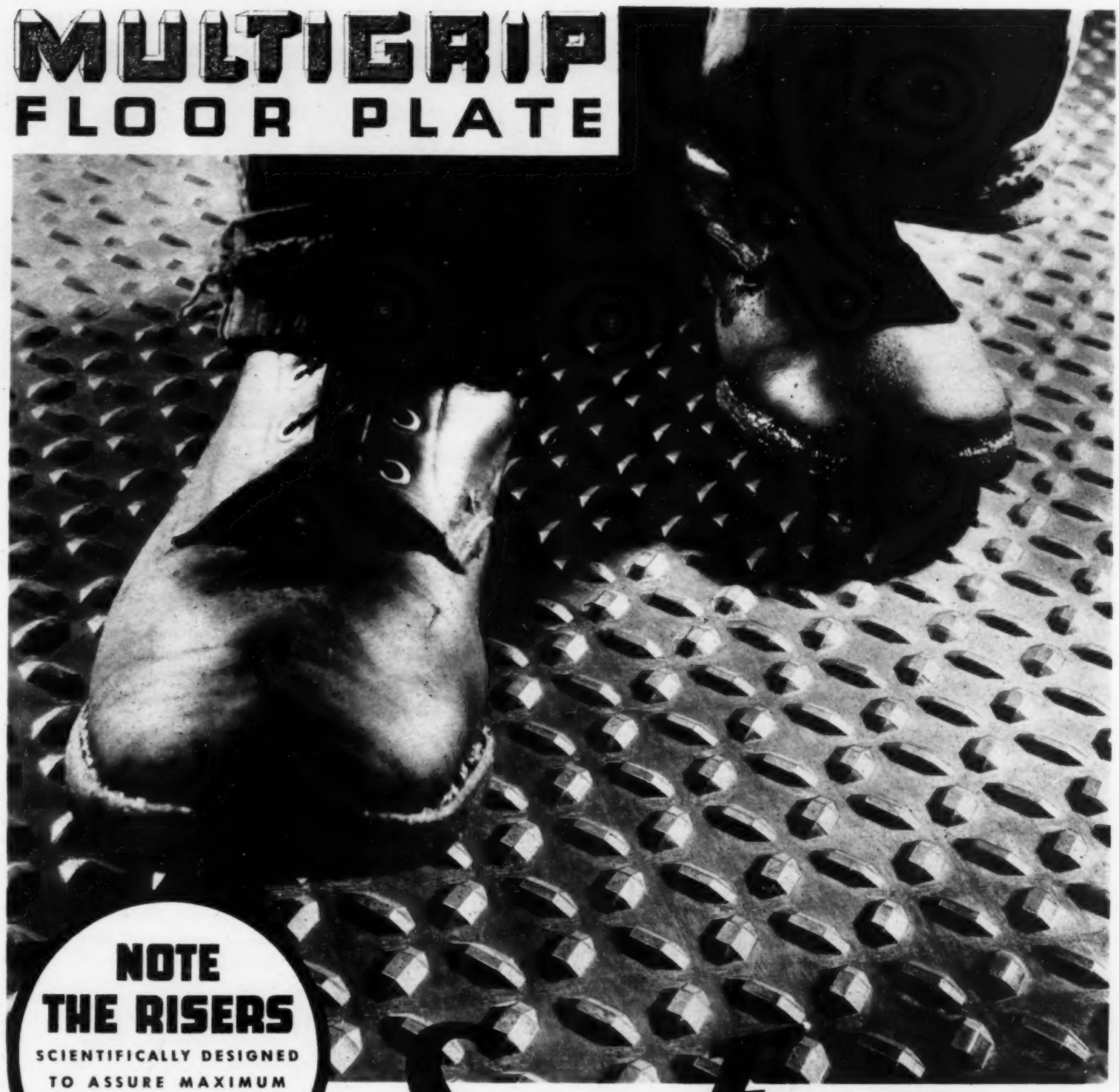

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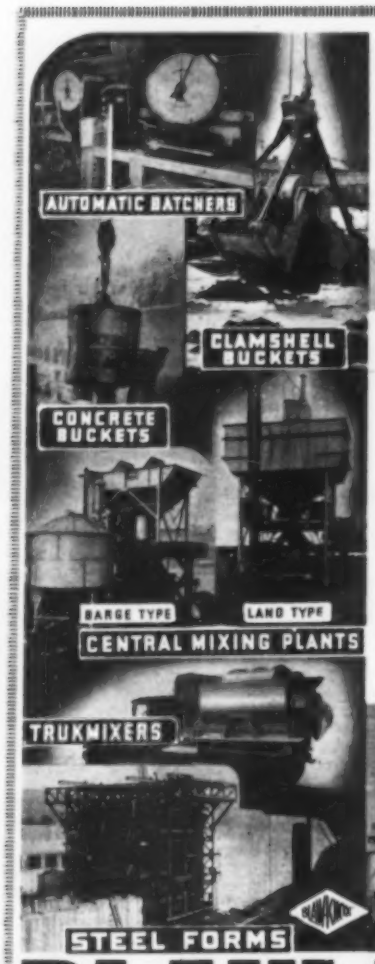

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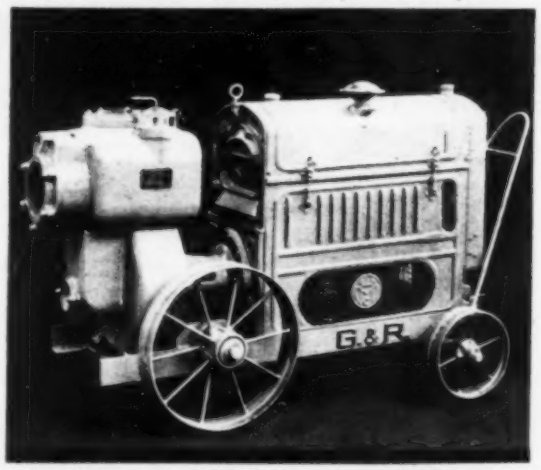

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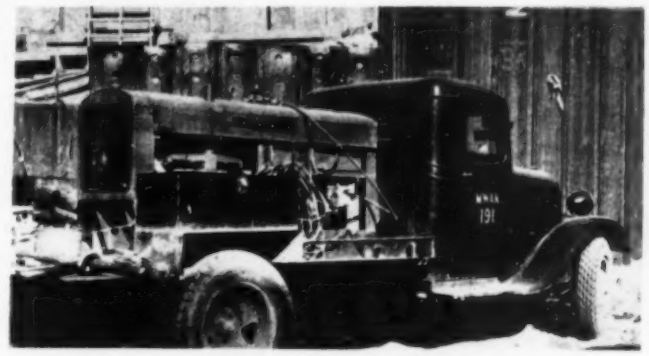

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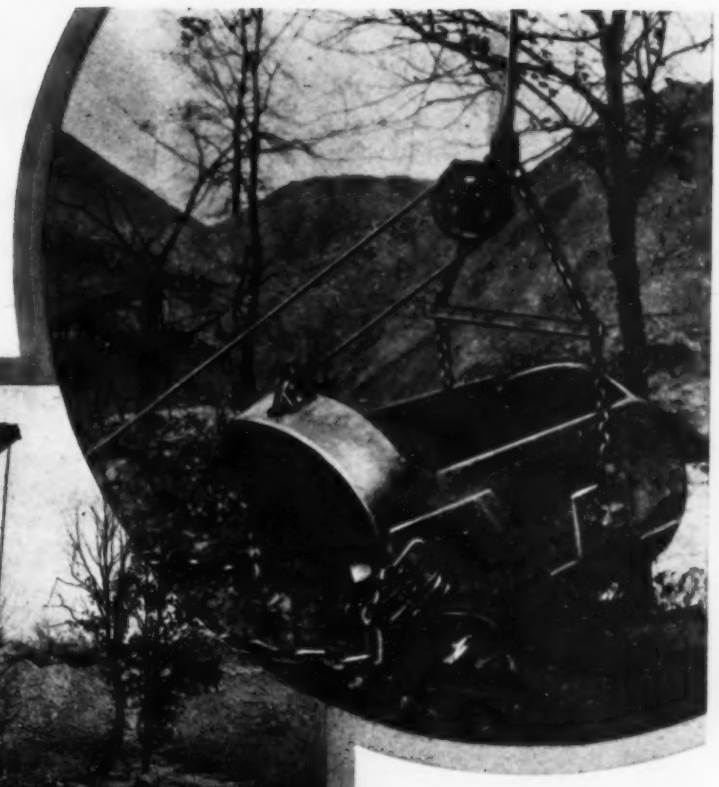
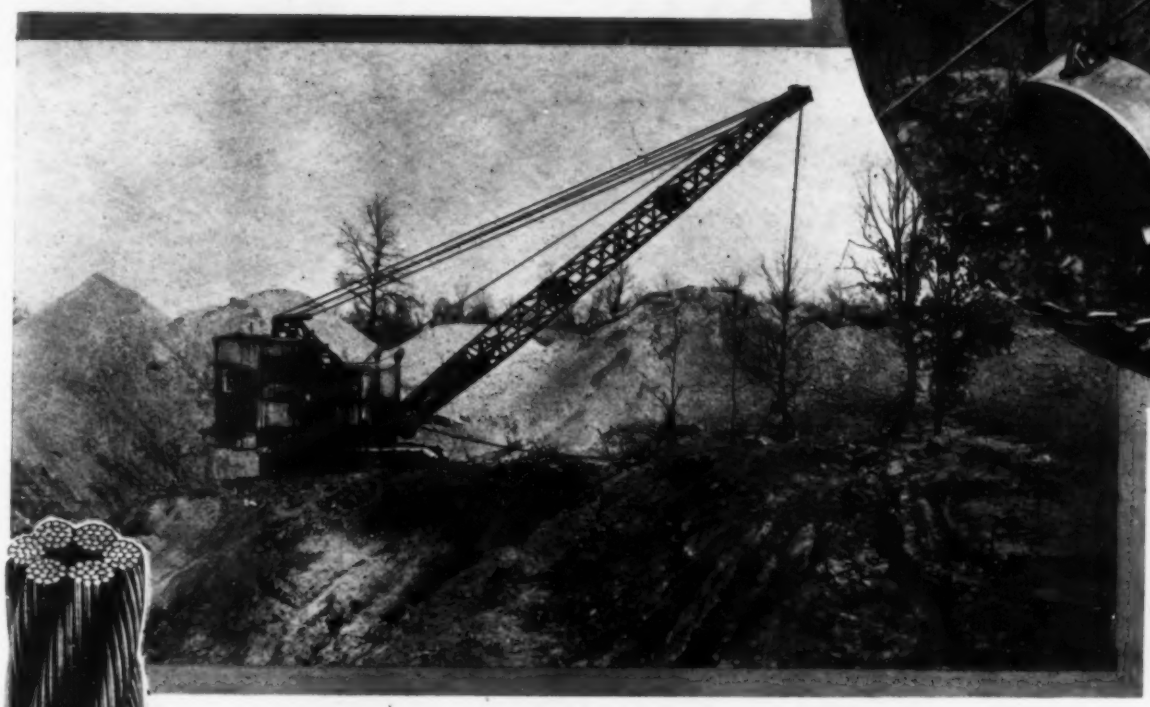
POP "More than *once*, Lad, more than once. And let that be a lesson to you not to get mixed up with welding machines that give only promises when you know that the '*Shield-Arc*' is guaranteed three ways to deliver more welding per dollar."

in spite of *jerking* · · ·

· · · *slamming* · · ·

fighting thru hardpan





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(Continued on page 88)

Control the Vital Factor in Building Roads Through National Parks

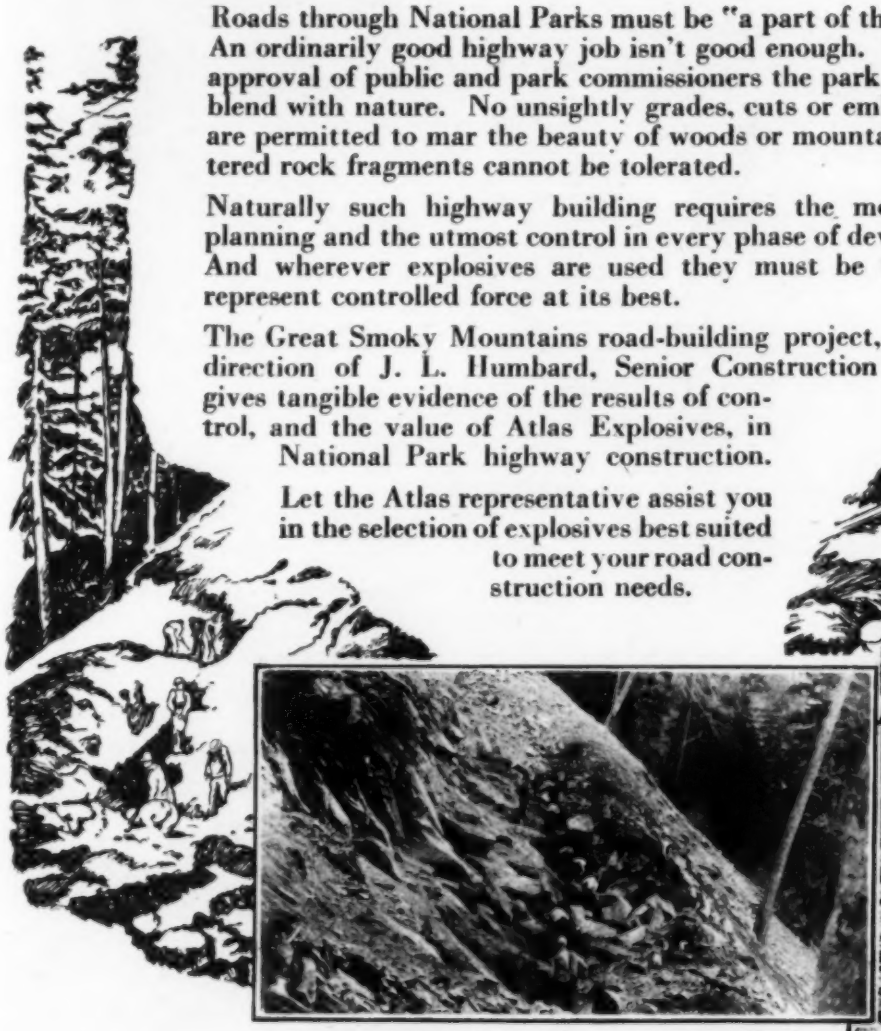
Tunnel looking west. Great Smoky Mountains National Park.

Roads through National Parks must be "a part of the picture." An ordinarily good highway job isn't good enough. To get the approval of public and park commissioners the park road must blend with nature. No unsightly grades, cuts or embankments are permitted to mar the beauty of woods or mountains. Scattered rock fragments cannot be tolerated.

Naturally such highway building requires the most careful planning and the utmost control in every phase of development. And wherever explosives are used they must be those that represent controlled force at its best.

The Great Smoky Mountains road-building project, under the direction of J. L. Humbard, Senior Construction Engineer, gives tangible evidence of the results of control, and the value of Atlas Explosives, in National Park highway construction.

Let the Atlas representative assist you in the selection of explosives best suited to meet your road construction needs.



Excavation for rubble mason wall. Great Smoky Mountains National Park. U. S. Bureau of Public Roads. J. L. Humbard, Senior Construction Engineer, Gatlenburg, Tenn.

Bridge Work. Great Smoky Mountains National Park.

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